PROPOSED NEGATIVE DECLARATION and ENVIRONMENTAL ASSESSMENT/INITIAL STUDY

for the

PROPOSED BLACKLOCK RESTORATION PROJECT

Suisun Marsh, Solano County, California
SRCD Ownership #635

Prepared By
Division of Environmental Services
California Department of Water Resources
and
U.S Bureau of Reclamation

July 2006

Proposed
Mitigated Negative Declaration
for the
Blacklock Restoration Project

The Project: The California Department of Water Resources (DWR), State lead agency and U.S. Bureau of Reclamation (Reclamation), Federal lead agency, propose to restore a 70 acre diked managed wetland in Suisun Marsh to a fully functioning tidal wetland using a passive strategy in which the exterior levee is breached, natural sedimentation and plant detritus accumulation restores intertidal elevations, and natural colonization establishes the plant and wildlife communities. The underlying restoration requirement for this site is subsidence reversal, as the site ranges from 3 to more than 5 feet below local mean high water. Tidal flow is expected to utilize the existing remnant channels to some extent, with some new channels forming as sedimentation progresses. This design is a minimal-engineering approach that relies on natural processes to meet project goals and objectives.

This restoration represents an opportunity to realize many of the ecosystem benefits that are commonly associated with healthy tidal marsh habitat including increasing the area of tidal brackish emergent wetlands in Suisun Marsh to aid in the recovery of listed and sensitive species. Implementation of this project will also allow for and encourage collaborative science opportunities that supports regional adaptive resource management needs and will lead to improved understanding of tidal marsh restoration processes, strategies, and ecological outcomes within Suisun Marsh.

The proposed project includes the following actions: Construct two 65 foot long breaches along the exterior levee. Excavated material will be placed in the adjacent borrow ditches as ditch blocks. This approach will promote full tidal exchange through the breach and increase the effectiveness of sediment deposition within the restoration site.

The proposed action is located in the eastern Suisun Marsh in western Solano County, as shown in Figure 1. The action area and locations of levee breaches are shown in Figure 2.

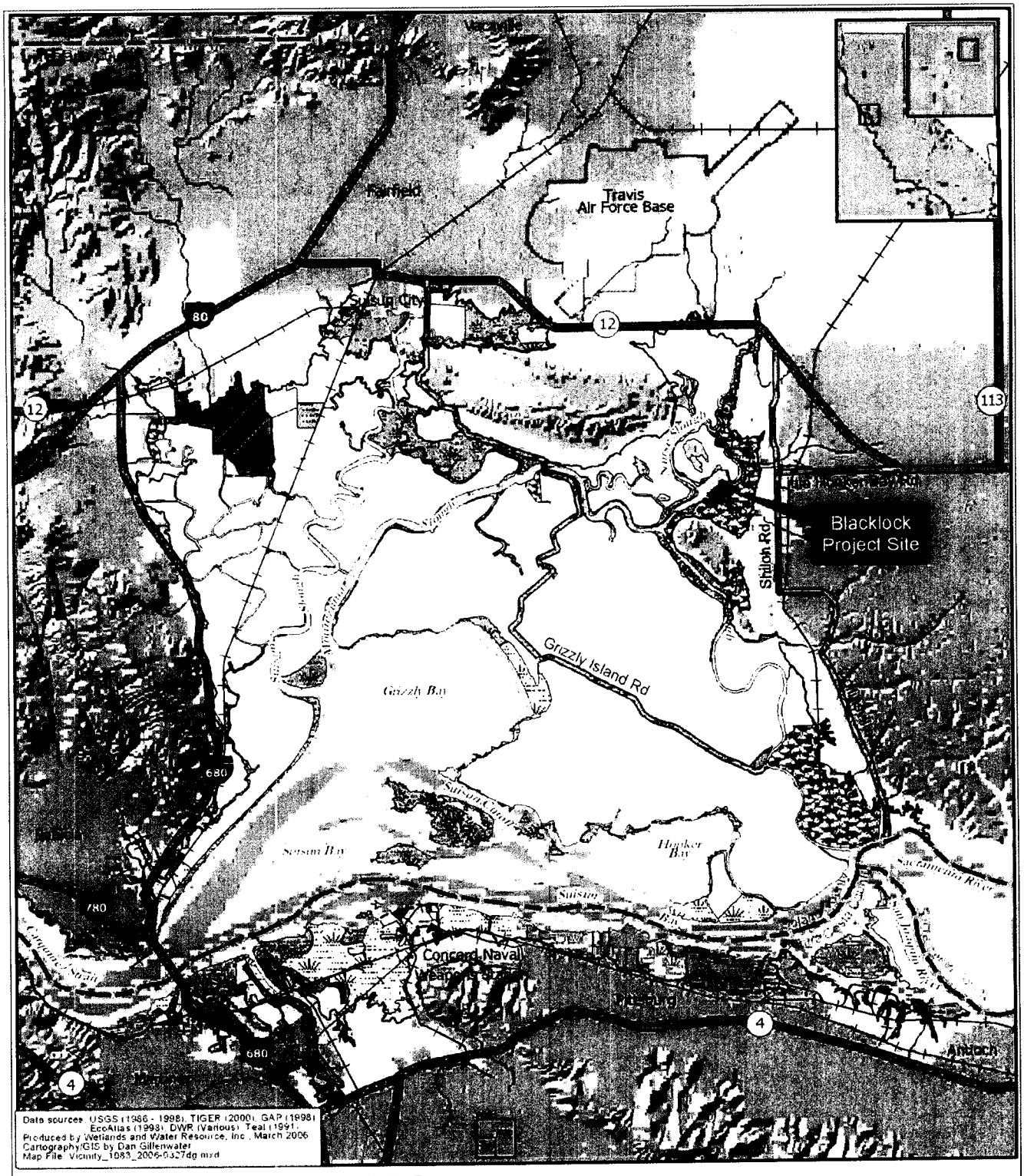
The Finding: DWR finds that implementing the proposed Blacklock Restoration Project as described in the Draft Environmental Assessment/Initial Study, will not have a significant negative environmental impact.

Basis for the Finding: Based on the Draft Environmental Assessment/Initial Study (attached), no significant environmental impacts will occur as a result of this project. Any potential impacts to sensitive species were addressed with wildlife agency staff. Avoidance and minimization measures have been incorporated into the project description to reduce potential impacts. Therefore, this Mitigated Negative Declaration is filed pursuant to Section 15070 of the Implementation Guidelines for the California Environmental Quality Act.

The public review period for this Negative Declaration and Environmental Assessment/Initial Study will end August 1, 2006. All comments or questions should be directed to DWR, Terri Gaines, 3251 'S' Street, Sacramento, CA 95816-7017 (916) 227-7522. Copies of the Initial Study/Environmental Assessment are available at the above address or by request.

Barbara McDonnell, Chief
Division of Environmental Services

June 28, 2006
Date



Reference Features

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1 cm = 1800 meters at letter layout)

0 1,800 3,600 5,400 7,200 Meters

0 5,900 11,800 17,700 23,600 Feet

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FIGURE 1: BLACKLOCK VICINITY

Blacklock Restoration Project
Solano County, California

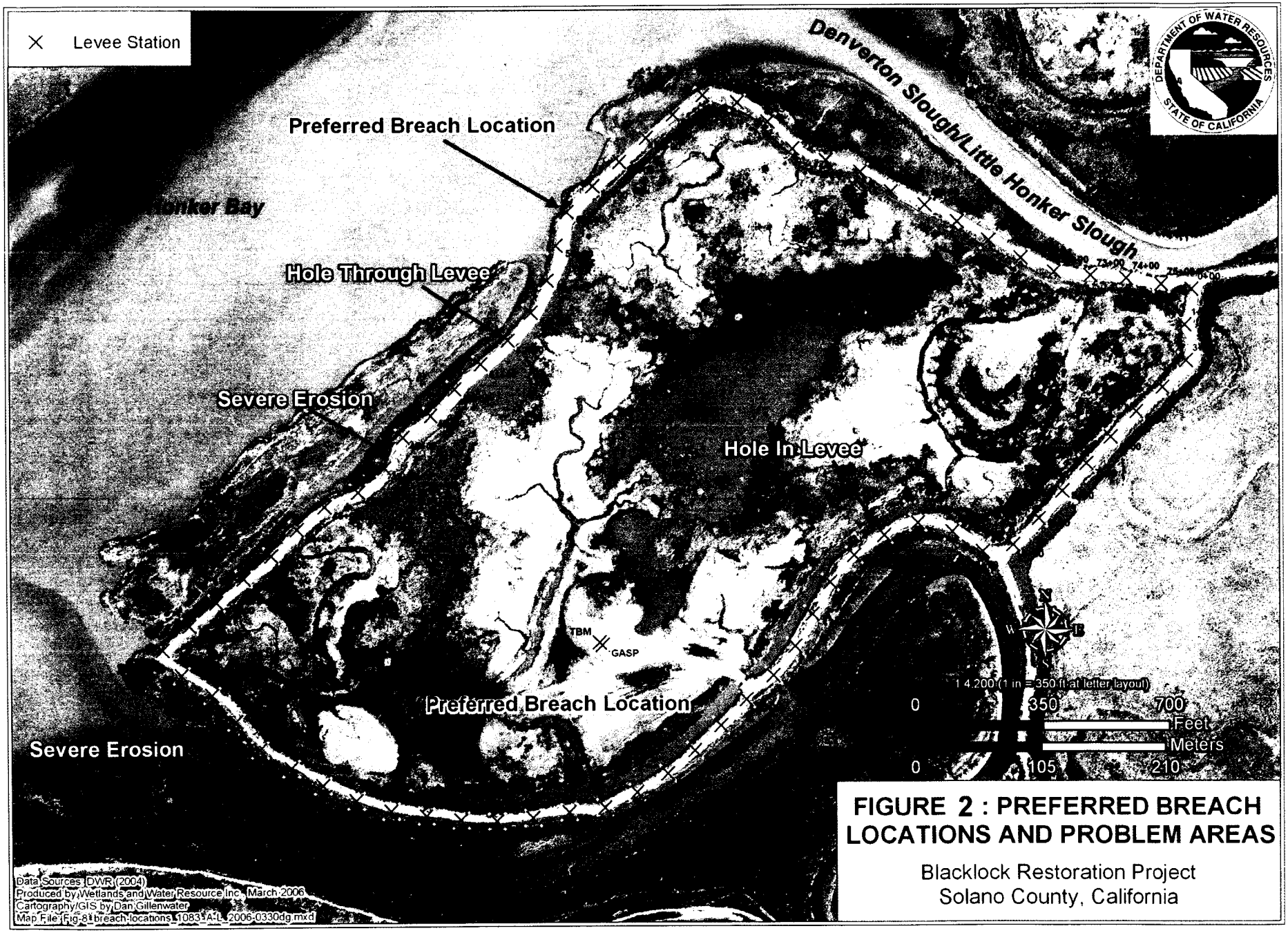

FIGURE 2 : PREFERRED BREACH LOCATIONS AND PROBLEM AREAS

Blacklock Restoration Project
Solano County, California

DRAFT ENVIRONMENTAL ASSESSMENT/INITIAL STUDY

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BLACKLOCK RESTORATION PROJECT
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BLACKLOCK RESTORATION PROJECT
EA/IS

List of Acronyms

ADCP	Acoustic Doppler current profiler
BCDC	San Francisco Bay Conservation and Development Commission
BLL	Blacklock water quality monitoring station
BMPs	Best management practices
CBDA	California Bay Delta Authority
CCR	California clapper rail
DEM	Digital elevation model
DFG	California Department of Fish and Game
DWR	Department of Water Resources
EC	Electrical conductivity
ECAT	Environmental Coordination and Advisory Team
USFWS	U.S. Fish and Wildlife Service
HDPE	High density polyethylene
MHHW	Mean higher high water
MLLW	Mean lower low water
MSL	Mean sea level
NAVD 88	North American Vertical Datum of 1988
NMFS	National Marine Fisheries
NOAA	National Oceanic and Atmospheric Administration
OBS	Optical backscatter
PRBO	Point Reyes Bird Observatory
RWQCB	Regional Water Quality Control Board
SCMAD	Solano County Mosquito Abatement District
SET	Sediment erosion table
SMHM	Salt marsh harvest mouse
SMPA	Suisun Marsh Preservation Agreement
SRCD	Suisun Resource Conservation District
SSC	Suspended sediment concentration
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geological Survey

1.0 INTRODUCTION AND PURPOSE AND NEED

The Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (USBR), in cooperation with the California Department of Fish and Game (DFG) and the Suisun Resource Conservation District (SRCD), have prepared this Environmental Assessment/Initial Study (EA/IS) for the Blacklock site (Figure 1). This EA/IS describes actions to restore 70 acres of diked, managed marsh to tidal wetlands, using a minimally engineered approach. Background and supporting documentation is presented in the Draft Restoration Plan (Appendix A). DWR released this Plan in April 2006. The Draft Restoration Plan was reviewed by the USFWS, DFG, USBR and SRCD and underwent CALFED Science Program independent review. Comments received were incorporated in the revised version dated June 2006. The Draft Plan (June 2006) is also available on-line at http://www.iep.ca.gov/suisun/restoration/blacklock/doc/BlacklockDraftRestorationPlan_061506.pdf.

USBR is the NEPA lead for this action. DWR is the California Environmental Quality Act (CEQA) lead. Cooperating agencies include DFG, SRCD plus the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (USACE) in an advisory role.

1.1 Background

Suisun Marsh, about 35 miles northeast of San Francisco in southern Solano County (Figure 1), provides habitat for numerous species of plants, fish, and wildlife. Historically, the Suisun Bay and Marsh included about 68,000 acres of tidal wetlands. From the mid-1880s to the early 1900s, over 90 percent of these wetlands were reclaimed for agriculture. Agricultural production and success was limited due to increased salinity in the Suisun Bay/Marsh region. Today, most of the levees originally constructed for agricultural reclamation now form part of the infrastructure for managing water levels in seasonal nontidal (managed) wetlands (Goals Project, 1999).

In 1987 DWR, DFG, USBR, and SRCD signed the Suisun Marsh Preservation Agreement (SMPA) to mitigate for adverse impact on the marsh resulting from operation of the State Water Project, federal Central Valley Project, and a portion of upstream diversions. Planned actions included construction of large scale facilities and management actions to provide channel water salinity of adequate quality for waterfowl food –plant production. The SMPA agencies revised the SMPA and its companion Mitigation and Monitoring Agreements in 2005. The Revised SMPA identified that Phase C funds of the Suisun Marsh Mitigation Agreement, a companion agreement to the SMPA, would be used for multi-species management in the Suisun Marsh.

A grant proposal, *Suisun Marsh Property Acquisition and Habitat Restoration Project*, was prepared and submitted by DWR in 2000 with collaboration from the Suisun SMPA Environmental Coordination and Advisory Team (ECAT), which includes DWR, USBR, DFG, SRCD, and USFWS. DWR acquired the Blacklock property in December 2003 using CALFED Ecosystem Restoration Program grant funds and Suisun Marsh Mitigation Agreement Phase C Mitigation funds. The Suisun Marsh Mitigation Agreement funds were provided for by the SMPA agencies to match CALFED grant funds. Since Suisun Marsh Mitigation Agreement Funding was identified as the source of cost-share funding for this effort, this became an ECAT project.

The grant proposal hypothesized that restoration of managed wetland habitat in Suisun Marsh to tidal wetland that includes low-marsh habitat, high-marsh habitat, and an upland transition zone would aid in the recovery of Suisun Marsh special status and listed plant and animal species, and could improve water quality in the Sacramento-San Joaquin Delta.

Since acquisition, and through restoration planning, DWR has maintained the property as a managed wetland and followed an "interim management" strategy of moist soil management to encourage the growth and spread of emergent vegetation on the site and allow for circulation throughout the property.

The Blacklock parcel has been flooded since late December 2005. Weather and high Delta outflows during winter 2006 resulted in higher than normal tides throughout Suisun Marsh, sometimes 1-2 feet above predicted levels. The flooding is due to overtopping of the levees at high tides and seepage through the levee in several locations.

The exterior levees of this parcel are in poor condition and continue to deteriorate. Areas of severe erosion have been documented since DWR acquired the parcel in December 2003 and have worsened over the years. Attempts to repair the most severe areas were attempted in 2004, but were unsuccessful. During winter 2005-06, two significant holes through the levee developed, at stations 14+00 (Arnold Slough side) and at 52+00 (Little Honker Bay Side) (Figure 2). In addition, there are several other locations where seepage occurs at higher tides. The parcel drains during low tide through the 30 inch culvert. Although the hole at 14+00 was repaired in April 2006, there is still more water flowing into the site than draining out, thus leaving the parcel in a flooded state. The existing condition of the levee, and high water levels in the adjacent sloughs may prevent the site from fully draining to its pre-flooded state prior to construction of breaches in the preferred locations.

Water level on the inside of the parcel is monitored as reservoir level of the BLL site on the California Data Exchange Center and is available at http://cdec2.water.ca.gov/cgi-progs/queryFx?s=bll. While water levels have fluctuated since the New Year, pickleweed and salt grass areas have remained flooded.

CEQA compliance for the acquisition of this property was completed when DWR filed a Notice of Exemption in May 2003. USBR prepared an Environmental Assessment and a FONSI in November 2003 to meet NEPA requirements. A detailed history of Suisun Marsh activities is described in the EA for acquisition, prepared by USBR in 2003.

USBR prepared an Environmental Analysis and FONSI for the Blacklock Restoration Site Water Quality and Meteorological Monitoring Station installation in July 2004. DWR filed a Notice of Exemption (information collection) in January 2004 for station installation to comply with CEQA.

1.2 Project Needs and Objectives

Purpose and Need

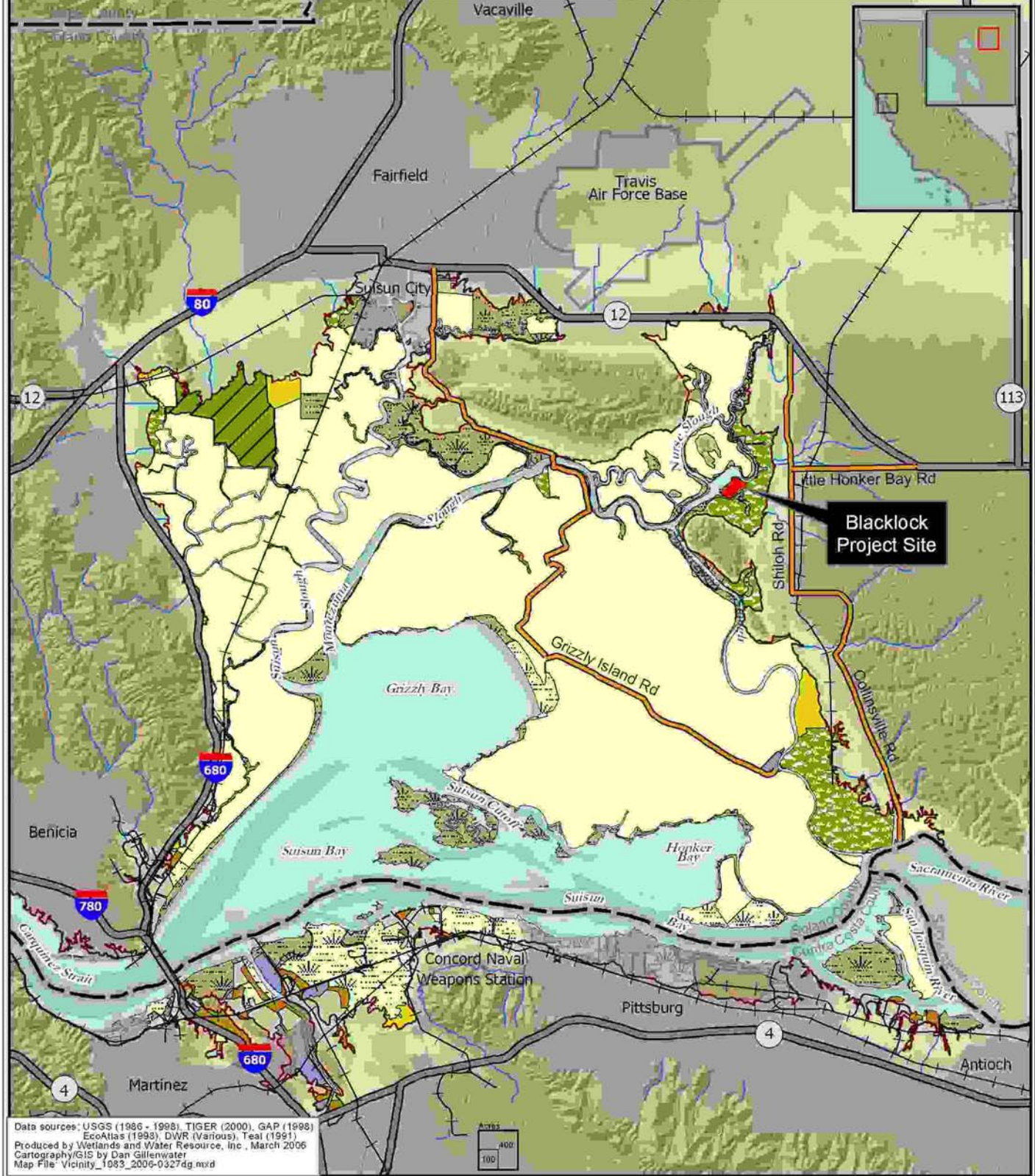
The purpose and need of this proposed federal action is to facilitate multi-species habitat needs addressed by the SMPA and CALFED ERPP, including efforts toward recovery of listed and special status Suisun Marsh species, through the restoration of the Blacklock site to a fully functioning, self-sustaining tidal wetland ecosystem that would provide high quality habitat for these listed and special status plants and animals, and acquire scientific knowledge to improve understanding of tidal marsh restoration processes, strategies, and ecological outcomes.

The goals and objectives guiding this project are as follows:

Goals: (1) To increase the area of tidal brackish emergent wetlands in Suisun Marsh to aid in the recovery of listed and sensitive species, and (2) acquire scientific knowledge that leads to improved understanding of tidal marsh restoration processes, strategies, and ecological outcomes within Suisun Marsh.

Restoration objectives: To restore the Blacklock property to a self-sustaining functioning brackish tidal marsh by restoring tidal action, reversing subsidence, and promoting establishment of native vegetation and a tidal marsh channel network appropriate to this location within the San Francisco Estuary.

Science objectives: To allow for and encourage collaborative science opportunities in the project design and monitoring phases that support regional adaptive resource management needs.



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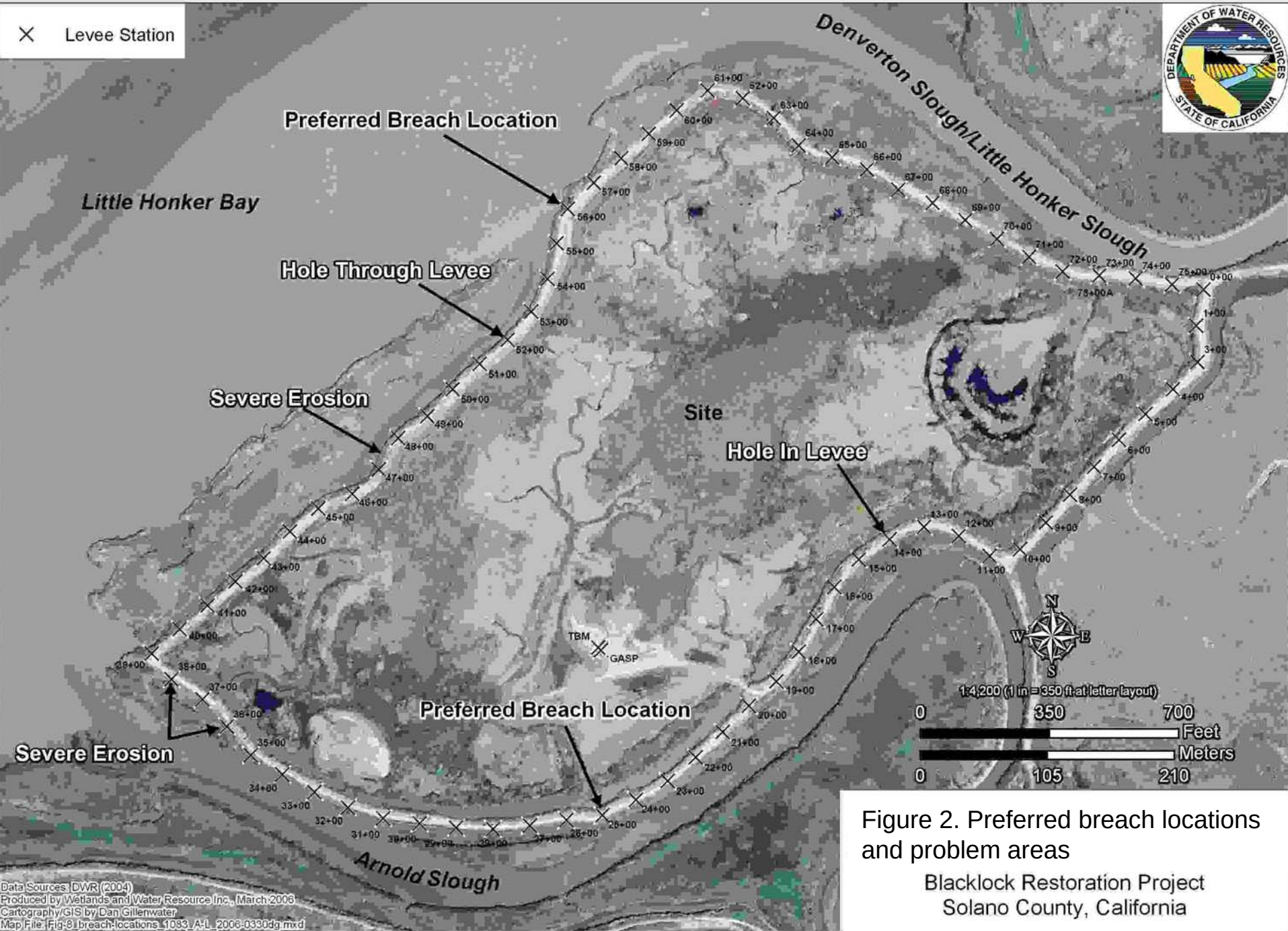


Figure 2. Preferred breach locations and problem areas

Blacklock Restoration Project
Solano County, California

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 Location

This property is identified as SRCD ownership number 635. It is located in the northeast Suisun Marsh bordering Little Honker Bay (Figure 1) on the north, and Arnold Slough on the west and south. The east side of the property is adjacent to Suisun Marsh ownership 604, a privately managed seasonal wetland. The property located on the Denverton USGS 7.5 minute topographic map at township 4 North, Range 1 East, Sections 19-20.

The parcel is approximately 70 acres, which includes about 67 acres seasonal wetland and 3 acres upland/levee. Existing site features include a diked, managed marsh, a partial remnant network of sloughs, an interior borrow ditch, and seasonally and perennially ponded areas (Figure 2). There is fringing tidal marsh on the outboard side of the exterior levees.

2.2 No Action

Under the No Action Alternative, levee breaches would not be constructed. The levees would continue to erode and a breach (or breaches) would likely occur in other locations along the exterior levee. Breaches in other locations would likely not have full tidal exchange initially. In addition, unintended levee breaches would not maximize sediment accretion (subsidence reversal) on the property. The property would continue with the existing interim management until the levee breaches.

2.3 Proposed Action

The proposed action is to restore this property to a fully functioning tidal wetland by constructing levee breaches in two locations. Once the levee is breached, the approach would be to use a passive strategy in which natural sedimentation and plant detritus accumulation restores intertidal elevations, and natural colonization establishes the plant and wildlife communities. The underlying restoration requirement for this site is subsidence reversal, as the site ranges from 3 to more than 5 feet below local mean high water. The project includes an interim management element to promote vegetation cover at the site prior to breaching to enhance natural restoration processes. Tidal flow is expected to utilize the existing remnant channels to some extent, with some new channels forming as sedimentation progresses. This design is a minimal-engineering approach that relies on natural processes to meet project goals and objectives. A detailed description of the design approach and hydrodynamic modeling conducted to determine the preferred locations is presented in Appendix A.

2.3.1 Anticipated Outcomes

Projected outcome scenarios are based on a variety of sources, use of computer models, and review of the literature and evaluation of other restorations within the San Francisco Estuary.

- The site would increase in elevation over time via natural sedimentation processes-mineral sediments moving in from Little Honker Bay and decomposition of vegetation on site.
- Full, unimpeded tidal exchange throughout the site.
- As elevations increase, vegetation will colonize throughout the site.

This restoration represents an opportunity to realize many of the ecosystem benefits that are commonly associated with healthy tidal marsh habitat. Fisheries benefits include providing habitat for delta smelt (*Hypomesus transpacificus*), longfin smelt (*Spirinchus thaleichthys*) Sacramento splittail (*Pogonichthys macrolepidotus*), chinook

salmon *(Oncorhynchus tshawytscha)* and other aquatic species. Targeted wildlife species include Suisun song sparrow (*Melospiza melodia maxillaris*), black rail (*Laterallus jamaicensis*), common yellowthroat (*Geothlypis trichas*) and other avian species.

Restoration of tidal flows will produce substantial changes to the habitats and biological, physical, and chemical functions of the site. Immediately after breaching, the site is expected to be shallow open water with remnant emergent vegetation during much of the tidal cycle and exposed pond bottom and remnant vegetation during low tides.

A new tidal channel network is expected to form, partially re-occupying remnant channels and otherwise forming within the newly forming tidal marsh surface. Vegetation will transition to a mix of species suited to the intertidal brackish environment, with the site eventually becoming fully vegetated except for channels. Some open water areas may persist in the long-term.

Knowledge expected to be gained from this restoration includes, but is not limited to, rates of sedimentation and marsh development, the role of existing emergent vegetation in influencing sedimentation, channel network formation and overall geomorphology, hydrology, water quality impacts, methyl mercury production, and species use. Results will inform scientists and decision makers in long-term land use and restoration planning throughout Suisun Marsh.

2.3.2 Preferred Approach: Constructed Levee Breaches

Modeling results indicate that the site drains better at low tide with two breaches on the property. Therefore, two locations, 55+00 and 25+00 are identified as preferred breach locations. Station 55+00, along Little Honker Bay (Figure 2) would allow for an unimpeded exchange of flows during tidal cycles. Because there is no in-channel island or fringing tidal marsh here, it is expected that a breach at this location would optimize the transport of available Little Honker Bay sediments into the property to raise surface elevation through sediment deposition. In addition, a breach at this location could take advantage of the remnant tidal slough network within the property. It is unlikely that an unintended levee failure would occur at this location. The levee is wider and higher than other areas and there is (remnant) riprap on the waterside slope and toe.

The second breach would be located along Arnold Slough, preferably at 25+00, which lines up with an existing channel and would serve the southwest corner well.

Modeling suggests that a breach size of at least 65 feet (20 meters) would be necessary for full tidal exchange. A detailed description of hydrodynamic modeling conducted for this project is included in the Appendix A. The site will be monitored to assess whether constructing the breaches in these locations will achieve project goals, objectives and desired outcomes. The site will be adaptively managed (as described in section 2.6) as necessary.

<u>Unintended Levee Failure</u>

Much of the exterior levee of this parcel is in poor condition. In addition to the hole near 52+00, several areas along the exterior levee are severely eroded (Figure 2). Erosion is most severe at 47+50 and from 36+00 to 38+00. Without additional maintenance to the levee near 52+00 and other severely eroded areas, DWR and SRCD staff as well as the project science advisor, Dr. Siegel, expect that a breach at one or more of these locations will occur within the next year, or possibly sooner.

In the event of an unintended levee failure at one of the expected or another location along the exterior levee, the site will be monitored to assess whether project goals, objectives and desired outcomes are being achieved.

Specifically, monitoring will focus on the tidal regime inside the parcel, evolution of the breaches, tidal exchange through the breach, marsh development, sediment accretion and elevation changes within the subsided lands. Biological objectives will also be evaluated including fisheries use at the site and vegetation development.

The Project Manager, in conjunction with the established Advisory Team and Science Advisor, will use this information to evaluate if the unplanned breach is sufficient for development of a functioning tidal marsh ecosystem. If not, the site will be adaptively managed to promote full tidal exchange and tidal marsh development. Options include increasing the size of the natural breach, deepening the natural breach, or creating additional breaches in the exterior levee. The likely location of an additional breach would be at 55+00.

2.4 Construction Methods

The levee would be breached during one low tide cycle, and would be scheduled to coincide with the lowest (projected) daylight tide during the available construction window. The typical maintenance and construction period in the Suisun Marsh is May through October 15th. The site would not be dewatered.

Construction will commence upon obtaining regulatory approval and is projected to occur prior to Oct 1, 2006. If all necessary regulatory permits have not been received by this date, DWR and USBR will confer with SRCD and the regulatory agencies to schedule construction.

In each location a 65 foot (20 meter) breach will be constructed using a long-reach excavator (Figure 2). A maximum of 1,000 yards of material would be excavated from each breach. Excavated material would be placed in the borrow ditches as ditch blocks to a level not to exceed MLLW. Any material placed in the ditches would not be compacted, but left as placed.

The material from the breach at 55+00 will be placed in the ditches on both sides of the proposed breach. This would cover an area of approximately 4,200 square feet (filling the ditch to MLLW). The material from the breach at 25+00 would be placed in only the east side of the breach, covering an estimated area of 4,050 square feet, filling the ditch to MLLW. These estimates were calculated using dimensions of the borrow ditches, site elevations and tidal datum.

If additional material is available (that cannot be placed in the ditch blocks as proposed), and if it is feasible to transport, it may be used to raise low areas of the exterior levee between 64+00 and 69+00 (Figure 5). Material would only be placed on the crown and would be graded when dry.

All heavy equipment would access the site from the levee. Access for heavy equipment would be from Shiloh Road, through the Blacklock Ranch (ownership 604), and to the site. DWR acquired an easement through this parcel when the restoration site was acquired in 2003. Excavation of a breach should be accomplished during one low tide period. Construction will be scheduled to coincide with the daylight low tides in September, assuming environmental clearances and permits have been obtained.

Dissolved oxygen will be monitored within the pond prior to breaching. Water will be exchanged and circulated, to the extent possible, using the water control structure. The breach at 55+00 would be completed first. This will allow for the exchange of pond water to enter Little Honker Bay, which has a larger volume than Arnold Slough.

During construction activities, avoidance and minimization measures and Best Management Practices (BMPs) for in-channel construction will be followed to ensure that this project is completed with minimal environmental impacts. A biologist will be on site at all times during construction.

2.4.1 Avoidance and Minimization Measures and Construction Best Management Practices

1. All work will be done between May 1 and October 15, described as the Suisun Marsh construction/maintenance period described in SRCD/DFG regional general permit #N214515 issued by the USACE.

2. Locations of levee breaches will be sited to avoid sensitive habitat, including potential SMHM habitat, where practical.

3. Pre-construction surveys for sensitive plant species will be done prior to commencement of work.

4. Salt marsh harvest mice (SMHM) will be surveyed at the breach locations prior to excavation according the protocol specified in DWR permit #835365-3 issued by the USFWS. This permit authorizes DWR to sample for SMHM within the Suisun Marsh. Surveys will be conducted for 7 consecutive days. If SMHM are present at specific breach locations:

    - The captured SMHM will be relocated to a suitable alternate location on the property and the USFWS will be immediately notified.
    - Surveys will continue until no SMHM are captured for 5 consecutive days.
    - Vegetation will then be hand-removed, followed by another trapping sequence.
    - Construction can commence after SMHM are NOT detected for 5 consecutive days after vegetation removal.

5. If SMHM are not present, vegetation will be removed (by hand) from breach locations immediately following surveys.

6. A qualified (permitted by USFWS) biologist will walk in front of the excavator as it moves down the levee towards the breach location to flush any SMHM that may be in the vegetation on the levee crown and shoulders.

7. Excavating equipment will work from levee crown. No equipment shall be operated in the water.

8. No intentional harassment, killing, or collection of plants or animals at or around the work site will occur.

9. Disturbance of vegetation shall be kept to a minimum. Trees will be flagged and avoided during construction.

10. No firearms are allowed on site, except for those used by peace officers or DFG wardens.

11. No pets will be allowed.

12. All persons will stay within the boundaries of the work site, which is the top of the levees and the water side levee slopes.

13. All trash, including food-related trash and cigarette butts, will be properly disposed of and removed by the workers.

14. Storage of hazardous materials, such as fuel, oil, etc. will not be allowed within 150 feet of waterways. Any chemical spills will be cleaned up and reported immediately.

This plan includes provisions for water quality protection and for implementing BMPs chosen to mitigate for construction activity pollutants. These measures are intended to prevent/minimize runoff into waterways and erosion. The Contractor shall implement this plan by conforming to the following provisions, where applicable:

1. Restrict personnel to designated roads.

2. Use methods for controlling erosion on designated roads.

3. Use methods for on-site erosion control and sediment capture methods during construction.

4. Minimize erosion during stormy weather at the work site.

5. Use methods for post construction erosion control.

6. Contact personnel and emergency procedures will be posted at the work site to avoid and minimize loss of property and life in case of a significant storm event.

7. The project RWQCB Water Quality Certification conditions will be strictly implemented.

8. All settleable solids, oils, and grease shall be contained to prevent their release into the environment. Flocculents may be used on solids that do not readily settle, as long as they do not degrade water quality.

9. Excess construction and operation materials, rubble, and excavated soil shall be either reused or disposed of in approved sites.

10. Exposed areas shall be stabilized with temporary mulching, or other erosion control methods during and after land disturbance activities.

11. Areas of disturbance with slopes toward a stream shall be stabilized to reduce erosion potential.

12. Stock piles shall be protected from erosion either by covering them or by placing barriers (e.g. silt fence, sand bags) around their perimeter to prevent the escape of sediments.

13. Spoil disposal areas shall be graded to ensure that drainage from these sites will minimize erosion of spoil materials and adjacent native soil material. Grading shall conform to the existing topography of the area.

14. Any construction measures shall be inspected during day light hours and after normal working hours during adverse weather conditions to observe proper operation. Any measure not operating properly or effectively shall be corrected immediately.

15. All reasonable efforts will be made to avoid on-site fueling. If fueling is done at the job site, containment shall be provided in such a manner that any accidental spill of fuel shall not be able to damage vegetation, enter the water or contaminate sediments that may come in contact with water.

16. All reasonable efforts will be made to avoid on-site servicing of equipment. If emergency repairs are required, containment shall be provided to avoid accidental spills from entering any channel or damage stream vegetation.

17. Measures shall be implemented to ensure that hazardous materials are properly handled and the quality of water resources is protected by all reasonable means.

18. Prior to entering the work site, all field personnel shall know how to respond when toxic materials are discovered.

19. The discharge of any hazardous or non-hazardous waste as defined in Division 2, Subdivision 1, Chapter 2 of the California Code of Regulations shall be conducted in accordance with applicable State and federal regulations.

20. Field personnel shall be appropriately trained in spill prevention, hazardous material control, and clean-up of accidental spills.

21. Spill prevention kits shall always be in close proximity when using hazardous materials (e.g., crew trucks and other logical locations).

22. Prior to entering the work site, all field personnel shall know the location of spill kits on crew trucks and at other locations within District facilities.

23. All field personnel shall be advised of these locations and trained in their appropriate use.

24. In the event that archaeological resources are encountered during construction on the property, work in the immediate vicinity of the find shall be halted until all requirements relating to archaeological discoveries have been satisfied.

2.5 Monitoring

This section describes the monitoring program that will accompany the Blacklock Restoration Project. The goals identified for this project include: 1) avoidance of adverse impacts from construction and restoration activities, and 2) restoration outcome monitoring.

2.5.1 Construction Monitoring

Monitoring activities designed to avoid and minimize impacts during construction are described above in Section 2.3.1 and in Chapter 3, Affected Environment and Environmental Consequences of the Proposed Action and Alternatives.

2.5.2 Restoration Outcome Monitoring

Monitoring will both document the expected beneficial effects of this project and detect potential impediments to successful marsh restoration as well as potential adverse outcomes. Monitoring for each of the performance criteria will continue until performance criteria are satisfied. If performance criteria are not met, the causes will be investigated and adaptive management actions/corrective measures will be implemented. It is anticipated that some elements of the monitoring program will become part of regional monitoring programs currently in place and developed in the future.

The performance criteria for the Blacklock Restoration are:

- High tide heights inside the site will be substantially similar to those observed outside the site, within two years following a planned or unintentional breach.
- Low tide heights inside the site will be no more than 1 foot greater than those observed outside the site, within two years following a planned or unintentional breach.
- Restored marsh plain elevations will continually trend upwards.
- Native tidal marsh species will colonize and establish at the site. Total percent cover shall be at least 50%. Species composition will be those species appropriate to the salinity regime and site elevations.

Monitoring components include:

- Inundation regime
- Levee breach geometry
- Surface elevation changes/sedimentation
- Slough network evolution
- Native marsh vegetation development
- Invasive plant species establishment
- Water quality including production of methyl mercury
- Nurse Slough monitoring network
- Aquatic species utilization
- Wildlife use

A preliminary monitoring plan and schedule is presented in Appendix A. Detailed monitoring plans will be developed during the ESA consultation process.

2.6 Adaptive Management

Adaptive management means taking informed, intentional actions designed to achieve pre-defined goals and objectives, observing the effects of those actions over a prescribed time period, evaluating the observed outcomes of those actions against a set of pre-defined criteria, and determining whether further actions should be taken based on those evaluations (Lee, 1993). In this adaptive management framework, it is critical to consider up-front what range of *feasible* actions could be taken, so that monitoring and decision making are focused on elements where intervention is possible and likely to have a measurable effect.

Whether tidal inundation occurs at Blacklock under a planned or unplanned event, adaptive management will be incorporated, as needed, to meet project goals and objectives. Physical and biological parameters will be monitored to evaluate success in meeting desired outcomes and to minimize undesirable outcomes. Physical parameters including tidal regime and breach geometry will be used as indicators for future actions. Monitoring these physical parameters, in addition to using the computer model as a predictive tool, will inform project

planners on specific actions that might be implemented. One important component of biological monitoring will be the use of this restoration site by listed species. Adaptive management will be incorporated, as needed and practical, to meet the goal of providing suitable habitat for listed species.

Because the existing conditions of the exterior levees suggest that levee failure would occur in some location other than our preferred breach location, deepening or widening of the breach may be required to achieve full, unimpeded tidal flow. Under the unplanned breach scenario, site conditions will be monitored and observed for at least one year to allow time for evolution of the breach.

The Adaptive Management Program for the Blacklock Restoration Project consists of the following elements:

- Milestone #1: At one year following breach (whether planned or unintentional), results of several monitoring parameters will be evaluated to determine whether any further actions are needed: the degree of tidal inundation, amount of sedimentation, breach geometry evolution, vegetation community changes, mosquito production, and invasive species colonization. These data will inform whether levee breaches need to be enlarged, new levee breaches added, or invasive vegetation control needed.

- Milestone #2: At two years following implementation of any changes following review at Milestone #1, results of the same parameters plus overall wildlife use and aquatic species use will be evaluated. These data will inform whether any final measures are warranted to alter the course of the site development to promote meeting its goals and objectives.

- Monitoring data review: In between and following these two milestones, monitoring data will be reviewed along with site observations made during monitoring, for early detection of desired or undesirable outcomes. If these reviews indicate clear adverse conditions prior to reaching either milestone, actions under those milestones would be moved forward as deemed appropriate by DWR and its Advisory Team.

2.7 Maintenance

2.7.1 Cross Levee Maintenance

To prevent flooding of the adjacent Blacklock Ranch, Ownership #604, the cross-levee was raised to 9.0 feet NAVD during 2004. During 2005, additional material was added to the cross-levee to restore the 2:1 side slope on the proposed restoration side of the levee. The base of the cross-levee was revegetated with *Schoenoplectus californicas* in December 2005. Brush boxes were installed on the cross-levee slope in late 2005 and January 2006 to provide wavewash erosion protection. In addition, woody vegetation was planted on the levee slope above the brushboxes. The brushboxes are expected to provide erosion protection for 3-5 years, giving time for the revegetated levee to mature. This alternative approach to protect the levee slope will be evaluated for effectiveness. If the brushboxes do not provide adequate protection, additional measures will be considered.

The east (non-project) side of the levee sustained moderate damage during the January 2006 storm and high tide event. The adjacent property flooded during the high tides and wind fetch across the open water of the adjacent parcel resulted in erosion to the east side of the cross levee. Once permits and material are obtained, this side of the levee will be repaired and revegetated. Maintaining the cross levee is, and will continue to be, a high priority.

2.7.2 Exterior Levee Maintenance

Maintenance on a portion of the exterior levee from 55+00 to 75+00 will continue to occur until the levee is breached at 55+00. In the event of an unintended levee failure, maintaining the levee from 55+00 to 75+00 is necessary to allow the excavating equipment access to the preferred breach location, unless a decision is made that a breach at the preferred breach location is not necessary. Sections of this levee, specifically around 64+00 through 69+00 are some of the lowest on the property, and frequently overtop at tides over 6.2 feet NAVD. However, since there is a wide fringing marsh in this location, which dissipates the energy of the high tides, this area does not have the heavily eroded waterside slope of other areas. Maintenance of this levee would likely include placing imported material to raise the levee and maintain access for equipment necessary to breach the levee, if needed.

In addition, the exterior levee will also be maintained from 11+00, the end of the cross levee, to 25+00 until a determination is made that unimpeded tidal exchange is achieved. Maintaining this section of levee along Arnold Slough will allow access from the cross levee to the water control structure and culvert under the well pad road.

Vegetation control including mowing and weed control will continue along the crown of the exterior levee to allow pedestrian access for as long as is practical. This will allow agency staff and those involved with the restoration access to evaluate levee and site conditions, and conduct monitoring. Access will be limited to foot traffic and ATV's since the levees are unsafe for larger vehicles.

It is expected that the remaining exterior levees will erode over time, resulting in additional breaches.

2.7.3 Invasive Species Control

Exotic plants and animals often thrive under conditions at wetland restoration sites (Zedler 2000). A program for the control of non-native invasive plant species will be developed as part of the vegetation monitoring plan for this project. Control of aquatic invasive species is likely to be difficult and will be best achieved by providing conditions more favorable to native species.

2.8 Permits

The following environmental regulatory requirements will be obtained:

- A Joint Aquatic Resource Permits Application (JARPA) was prepared and submitted to the appropriate agencies to address the following regulatory requirements:
    - Clean Water Act Section 10 and 404 – Nationwide Permit 27 Wetland Restoration Activities; USACE Regulatory Division, San Francisco;
    - Clean Water Act Section 401 – State Water Resources Control Board, San Francisco Bay Region 2, Water Quality Certification notification;
    - San Francisco Bay Conservation and Development (BCDC) permit
- Federal Endangered Species Act – USBR is consulting with USFWS and NMFS on potential effects of the action to listed, proposed, and candidate species;
- California Endangered Species Act – DWR is consulting with DFG on sensitive species concerns;

- California Environmental Quality Act (CEQA) – This Initial Study is being prepared in compliance with CEQA. As a result of the findings of this document, a Mitigated Negative Declaration will be filed with the California Office of Planning and Research.

- National Environmental Policy Act (NEPA)- This Environmental Analysis is being prepared in compliance with NEPA. Based on the results of the analysis, USBR has prepared a draft finding of no significant impact (FONSI).

- Magnuson-Stevens Fishery Conservation and Management Act – USBR is consulting with NMFS on potential effects of the action on designated Essential Fish Habitat; and,

- National Historic Preservation Act Section 106 – Consultation within DWR will address this issue.

3.0 ENVIROMENTAL SETTING, AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

3.1 Introduction

The environmental setting describes the physical features of the project area; the affected environment describes the existing conditions of environmental resources, including biological resources in the project area that may be affected by the proposed action and alternatives. The "environmental consequences" section forms the scientific and analytic basis for the comparison of alternatives, comprising the proposed action and no action.

A comprehensive list of Federal endangered and threatened species that occur or may be affected in the Denverton U.S. Geological Service (USGS) 7 ½ minute quad (Appendix B) was generated online on June 28, 2006 at http://sacramento.fws.gov/es/spp_lists/auto_list.cfm. Because this list includes all species found on the quad maps, which is a larger geographic area than the proposed action area, several species are included on the list that will not be affected by the proposed action and will not be evaluated in this document.

To meet CEQA requirements, an environmental checklist was prepared and is included as Appendix C. Explanations of items evaluated to have 'less than significant impact' are included at the end of the checklist. None of the proposed actions were considered 'less than significant with mitigation incorporated' or 'potentially significant' impacts.

The following features of the project area are described below in the environmental setting:

- Regional biology
- Ecosystem types
- Climate
- Topography
- Soils
- Hydrology
- Suspended sediment concentrations
- Land use
- Constraints
    - Levees
    - Abandoned gas wells
    - Vector control

The following environmental resources are analyzed in this environmental assessment/initial study.

- Upland communities (including noxious weeds) and wildlife habitat
- Wetland plant communities and special status plants
- Terrestrial endangered species
- Fish and aquatic special status species
- Recreation
- Water Quality
- Air Quality
- Cultural Resources
- Indian Trust Assets

- Environmental Justice

This document will assess effects of the proposed action on the following ESA listed species:

- Salt marsh harvest mouse (USFWS)
- California clapper rail (USFWS)
- Central Valley steelhead (NMFS)
- Central Valley spring-run chinook salmon (NMFS)
- Winter-run chinook salmon and winter-run chinook salmon critical habitat (NMFS)
- Delta smelt and Delta smelt critical habitat (USFWS)
- Green sturgeon (NMFS)
- Suisun thistle (USFWS)
- Soft bird's-beak (USFWS)

This document will assess project effects on the following Species of Concern:

- Saltmarsh common yellowthroat (USFWS)
- Suisun song sparrow (USFWS)
- California black rail (USFWS)
- Mason's lilaeopsis (USFWS)
- Suisun Marsh aster (USFWS)
- Delta tule-pea (USFWS)
- Suisun ornate shrew (USFWS)
- Western pond turtle (USFWS)

This document will assess project effects on the following Essential Fish Habitat:

- Coastal Pelagic Fishery Management Plan
    - Northern anchovy (NOAA Fisheries)
    - Pacific sardine (NOAA Fisheries)
- Pacific Salmon Fishery Management Plan
    - Fall-run and late fall-run Chinook salmon (NOAA Fisheries)
- Pacific Groundfish Fishery Management Plan
    - Starry flounder (NOAA Fisheries)

Action Area

The action area includes all areas to be affected directly or indirectly by the project and not merely the immediate area involved in the action. The action area for this project includes the entire 70 acre property, adjoining sloughs of Little Honker Bay in the vicinity of the preferred breach location (Figure 2).

Basis of Comparison

The basis of comparison under NEPA is the no action conditions.

3.2 Environmental Setting

3.2.1 Regional Biology

The regional biology of the Suisun Marsh is described in general in the Bayland Habitat Goals Report (1999) and the final report prepared in 2001 by the Suisun Ecological Workgroup at the request of the State Water Resources Control Board. This report can be found on line at http://www.iep.ca.gov/suisun_eco_workgroup/final_report/SEWFinalReport.pdf. Most of the Suisun Marsh is

diked seasonal wetlands managed for waterfowl habitat. A few tidal marshes remain along Suisun and Cutoff Sloughs (Rush Ranch), Hill Slough, and Peytonia Slough. Marsh ponds exist to a limited extent in low areas of diked baylands.

3.2.2 Ecosystem Types

The site is characterized by 3 main ecosystem types: upland, seasonal wetland, and aquatic. The upland areas of the site are restricted to the levees and the abandoned well pad. The sloughs and pond areas comprise the aquatic areas of the site; over the past several years, water has remained in the central portion of the site year-round. Before inundation in January 2006, the majority of the site was a managed seasonal wetland. The distribution of vegetation present is primarily a function of the topography on the site and inundation due to water management. Analysis of the project on these ecosystem types is presented in section 3.3 below.

3.2.3 Climate

Climate in the project area, like much of this part of Solano County is characterized by hot, dry summers and cool winters. In the summer, there is a steady marine wind (delta breeze) that blows up through the Suisun Marsh. Average annual rainfall in Solano County ranges from 16 inches to 30 inches per year. The monitoring station installed at the project location measures precipitation, wind speed and direction, and barometric pressure. Because the station was only installed in 2004, long-term data is not yet available from this station.

3.2.4 Topography

DWR conducted a field elevation survey of the site in August 2002. Figure 3 shows the digital elevation model (DEM) created by DWR and updated by WWR using the topographic data. Elevations at the site range from approximately -1.9 feet up to 9.2 feet (NAVD 88). With the exception of the levees and the two well sites, most of the property is subsided, with elevations less than about 3 feet in some locations, and less than about 1 foot on most of the site. The mean sea level at this location is approximately 4 feet. Additional elevation surveys were conducted on the perimeter borrow ditch and slough network during 2005.

3.2.5 Soils

The U.S. Department of Agriculture soil survey for Solano County (Miller et al. 1975) shows only two soil types at the Site. The area inside the levee is Tamba Mucky Clay, and Tidal Marsh soils are present outside the levees.

The Tamba soil series consists of very poorly drained, fine-textured soils with a high organic matter component. The soils occupy nearly level salt and brackish water marshes and are formed in mixed alluvium from mixed sources and hydrophytic plant remains. In a typical profile, the mucky clay extends to a depth of more than five feet.

This very poorly drained soil is moderately permeable. The surface runoff is ponded and the erosion hazard is slight to none. The total available water holding capacity is 3-5 inches. The effective rooting depth is shallow and the soil has low fertility. Areas with this type of soil association are typically used for wildlife habitat, recreation (irrigated duck ponds) and grazing.

The tidal marsh soil is a very wet, poorly drained, and strongly saline soil type that has unobstructed access to tidal water. This land ranges from unvegetated mud flats that are inundated daily by tidal flow to a mixture of hydrophytic plant remains and alluvium that is covered by water only at high tide and are (at this site) thickly

vegetated with *Schoenoplectus Bolboschoenus* and *Typha*. Permeability and runoff rates are low with these soils. Effective rooting depth is very shallow and fertility is very low. This land type is used for wildlife habitat and recreational uses (Miller et al. 1975).

3.2.6 Hydrology

Because of the location and relative isolation of the parcel, there are no watershed inflows that would affect the hydrology of the site except under extreme tidal/flooding scenarios as occurred in 1998, 2005 and 2006. Tidal inundation, as described below, along with site elevation, has the greatest influence on the development of a fully functioning tidal marsh. As a managed wetland, the hydrology of the site was primarily controlled by one 36-inch water control structure located along Arnold Slough (Figure 4); however, holes and seepage through the levee and uncontrolled intermittent levee overtopping also impacts water levels. The pond has been flooded since January 2006.

Water Control

There is one water control structure for both flooding and draining the property. The structure consists of a 36-inch corrugated metal pipe with a screw-flap gate on the slough side and a winch flap gate on the interior side. The gate was installed in the summer of 1998 and is in good working order. There is also a 48-inch pipe under the road to the well pad to allow circulation in the borrow ditch that runs along the interior toe of the levees. This culvert under the road was replaced with high density polyethylene (HDPE) pipe in August 2005. A flashboard riser was installed on the west side of the pipe, and will be closed upon breaching of the levee to reduce circulation in the perimeter borrow ditch.

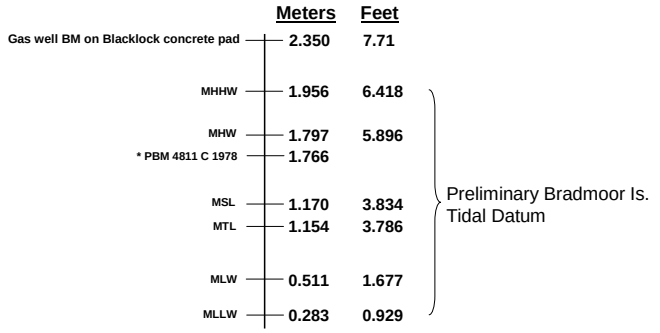
Tidal Datum

A water quality monitoring station was installed at the northeast corner of the Blacklock property (Figure 4). This station monitors tide stage, electrical conductivity (EC) and temperature in Denverton /Little Honker Slough. The station also monitors precipitation, wind speed and direction. In addition, a pressure transducer was installed in the borrow ditch of the Blacklock property to monitor interior water levels. After breaching, this sensor will provide data on the extent of tidal inundation. This station is identified as BLL on the California Data Exchange Center network. Hourly data is available on-line at http://cdec2.water.ca.gov/cgi-progs/queryFx?s=bll.

Additionally, DWR contracted with the National Oceanographic and Atmospheric Administration's Ocean Service / Center for Operational Oceanographic Products and Services to install a water level observation gauge on Bradmoor Island in 2004 where it had previously operated a station in the 1970's (Station ID NOS 941-4811). The purpose of the gauge is to determine the tidal datum (heights and range of the tides) for the Nurse Slough/Denverton Slough complex in the northeast Marsh, in the vicinity of the Blacklock property. Tidal datum from Bradmoor Island is presented in Table 1.

Table 1 - Tidal Datum Diagram of Bradmoor Island Tides

NAVD88 Tidal Datum Diagram for Bradmoor Island Tides



Preliminary data based on 4 months of data collected from April - July 2004
*** Primary Bradmoor Bench Mark**
Gas well BM tied to GPS network station BR2 near Mr. Blacklock's dock (7.01 ft NAVD88). GPS elevation of Gas well resurveyed in 2005 by WWR.

Existing Slough Network

There are remnants of the historic tidal marsh slough network on the site. DWR surveyed slough topography as part of its August 2002 survey. To supplement the original survey, additional surveys of the slough bottoms were conducted in March 2005. These remnant sloughs range in width from 5 to 15 feet and in depth from ½ to 2 feet across the site. In addition, there is a perimeter borrow ditch around the property along the interior toe of the exterior levee. Over the years, material has been removed from this ditch and used to maintain the levees. An elevation survey of this ditch was conducted in 2005. The width of the borrow ditch varies from approximately 10 feet to 35 feet wide and extends into ponded areas at several locations throughout the parcel.

3.2.7 Suspended Sediment Concentration

Researchers at San Francisco State University conducted in-situ suspended sediment sampling at two locations (Little Honker Bay and Arnold Slough) outside the Blacklock site from 2004 through 2006. A detailed description of the sampling methodology and results are presented in Appendix A.

In Little Honker Bay, suspended sediment concentrations (SSC) ranged from a low of about 20 mg/L to nearly 500 mg/L, with most values being less than 200 mg/L. Data shows a small spring-neap tide cycle signal. SSC tended to be higher in the winter and spring months and lowest in the fall months. At Arnold Slough, concentrations ranged from a low of about 30 mg/L to a high of about 430 mg/L, with most values being less than 150 mg/L. Arnold Slough shows the same seasonal pattern observed at Little Honker Bay.

The SSC difference between the two stations shows greater SSC values at Little Honker Bay during winter, spring and summer months, with the difference ranging from 10-30 mg/L commonly and in some instances up to 200 mg/L. Values were higher at Arnold Slough during the fall, by about 10-20 mg/L typically.

These results provide two beneficial pieces of information. First, they indicate that a reasonable sediment supply exists to support natural sedimentation within the Blacklock site. The values observed are within commonly seen ranges elsewhere in the San Francisco Estuary where natural sedimentation is known to occur in tidal marsh restoration sites (PWA and Faber 2004). Sediment accretion will be measured by using the three Sediment Erosion Tables installed within the project area (Figure 4). Second, these data can support sediment transport

modeling that DWR may undertake after project construction to develop more insight into physical processes promoting tidal marsh restoration in Suisun.

3.2.8 Land Use

The Blacklock restoration site was owned and operated by the Blacklock family since 1936, and was used for livestock grazing and duck hunting activities since 1946 (DWR 2003). The past owner used the entire Blacklock Ranch property primarily for grazing, with some waterfowl hunting in the southwest portion of the Blacklock Ranch including the 70 acres acquired by DWR. Management on the wetland area was minimal, consisting primarily of flooding and circulation during duck hunting season. Prior to DWR ownership, levee maintenance appears to have been minimal and inadequate to protect the property from occasional tidal overtopping. The levees were maintained primarily by borrowing material from the interior toe ditch. It appears that rip-rap was periodically imported to maintain a portion of the exterior levee along little Honker Bay.

Since acquisition, and through restoration planning, DWR has maintained the property as a managed wetland and followed an "interim management" strategy of moist soil management to encourage the growth and spread of emergent vegetation on the site and allow for circulation throughout the property. Water control on the site is achieved through the existing 36-inch culvert. In late summer of both 2004 and 2005, the pond was drained (to the extent possible) to allow for construction work on the cross levee. Once levee construction was completed, the property was re-flooded to previous levels.

The property includes approximately 1.5 miles of levees consisting of 1.3 miles of exterior levees and approximately 0.2 miles of an interior "cross" levee. The exterior levees are along Little Honker Bay or adjacent sloughs. DWR surveys conducted during summer 2004 indicate the elevations of the exterior levees range between 6.4 and 9.2 feet NAVD, with an error of 0.5 foot. Overtopping of the levee occurs in several locations during high tides. Figure 5 shows the locations where the levee is less than 7 feet NAVD and susceptible to overtopping in high tides. The width of the levee crown is variable, ranging from 6 to 10 feet.

The exterior levees are in extremely poor condition. There is significant erosion in many locations and large holes through the levee (Figure 2). Seepage through the levee occurs in several locations at high tides.

<u>Cross-Levee</u>

There is a short interior levee (~1,100 feet) between the Blacklock property and the adjacent Blacklock Ranch. Because the poor condition of the exterior levees on the property poses a risk for levee failure and unplanned breaching, this cross levee was raised to elevation 9 feet during September and October 2004. The nine foot elevation will protect the adjacent property from flooding in the event of an unplanned levee failure, and minimize DWR's flood liability, when the property is opened to the tides. All levee work was authorized under the USACE regional general permit 24215N issued to SRCD and DFG. The RGP sets limits on the quantity of material each property is allowed to place; thus DWR was unable to import sufficient material to construct the levee with the desired slope during 2004. Additional material was placed on the (west) slope during the 2005 construction season to restore a 2:1 side slope to the levee. Imported material was used to raise the levee. The material was tested for contaminants prior to placement and met applicable RWQCB standards.

During January 2006, the levee slope and toe was revegetated with *Schoenoplectus californicus (*previously called *Scirpus californicus)*. This species will remain viable during the winter months. It is anticipated that this species will colonize up the levee slope with inundation of the parcel when tidal action is introduced to the site.

To protect the levee slope from wind and wave erosion, brush boxes were installed on the cross levee slope in early 2006 as an alternative to rip rap for levee slope protection. Brush boxes are constructed by driving 2

parallel rows of 3-inch diameter wooden poles along the levee slope. Recycled Christmas trees were placed between the poles and secured in place. This method has been used successfully in other areas of Suisun Marsh and in the Sacramento-San Joaquin Delta.

Under existing conditions, the adjacent Blacklock Ranch floods via overtopping of its levees under extremely high tides. This condition occurred during the January 2006 storm event. This flooding is unrelated to the Blacklock Restoration Project. Therefore, while maintaining the cross levee to maintain existing levels of flood protection is a high priority for this project, the purpose is to maintain existing levels of flood protection provided by the restoration site, and not to protect adjacent lands from any flooding.

3.4.9 Constraints

3.4.9.1 Levees

The exterior levees of this parcel are in poor condition and continue to deteriorate. Areas of severe erosion have been documented since DWR acquired the parcel in December 2003 and have worsened over the years. Attempts to repair the most severe areas were attempted in 2004, but were unsuccessful. During winter 2005-06, two significant holes through the levee developed, at stations 14+00 (Arnold Slough side) and at 52+00 (Little Honker Bay Side). In addition, there are several other locations where seepage occurs at higher tides. Although the hole at 14+00 was repaired in April 2006, there is still more water flowing into the site than draining out, thus leaving the parcel in a flooded state.

3.4.9.2 Abandoned Gas Wells

The property contains two abandoned gas wells. The well pad for Blacklock Number One was dismantled and removed from the site; while the well pad for Blacklock Number Two is still intact (Figure 4). Remnants of the roads leading to the well pad still exist on the site. Details on abandonment of these gas wells are described in Appendix A.

3.4.9.3 Vector Control

Since acquiring the property, DWR has worked cooperatively with the Solano County Mosquito Abatement District (SCMAD) to control mosquito production on-site. SCMAD has developed policies for management of tidal marsh restorations. DWR will continue to work cooperatively with SCMAD.

3.3 Affected Environment and Environmental Consequences of the Proposed Action

3.3.1 Upland Communities and Wildlife Habitat

Affected Environment

The upland habitat in the action area is primarily confined to the levee crown and shoulders, although there is a limited amount of upland area in the location of the well pad. Most of this habitat is of poor quality. The habitat consists primarily of fragmented non-native weeds along the levee crown. There is no connection to the nearby contiguous grassland habitat.

Local plant surveys of the action area were conducted in December 2003, and additional surveys will be conducted prior to project initiation as required. The purpose of these surveys is to identify the presence of any special status plants, and to assess present vegetation communities. Common plant species growing at the project site include the following: tules (*Schoenoplectus [Scirpus] acutus, S. californicus*), California rose (*Rosa californica*), cattails (*Typha latifolia, T. angustifolia*), wild radish (*Raphanus sativus*), blackberry (*Rubus discolor*), saltgrass (*Distichlis spicata*). No sensitive plant species were found in the action area.

Environmental Consequences of the No Action

Under the no action alternative, DWR and USBR would not construct the levee breaches. The amount of upland vegetation and the current management practices would not change under the no action alternative. There would be no change in upland habitat from existing conditions described above.

Environmental Consequences of the Proposed Action and Alternative Action

The proposed action would remove about a 65 foot length of levee crown, in two locations along the levee (stn. 25+00 and stn. 55+00). The proposed action would result in a nominal change in the quantity and quality of upland habitats, thus, the proposed action would not adversely affect wildlife that use the upland plant community within the action area.

3.3.2 Terrestrial Special-Status Species

3.3.2.1 Salt Marsh Harvest Mouse *Reithrodontomys raviventris*

Affected Environment

SMHM (*Reithrodontomys raviventris*) is a federal and State endangered species endemic to the brackish and salt water marshes around the San Francisco Bay Estuary. There are two subspecies, and it is the northern subspecies, (*R.r. haliocetes*), that is found in the Suisun Marsh. SMHM are dependent on the thick, perennial cover of salt marshes and move in the adjacent grasslands only in the spring and summer when the grasslands provide maximum cover (Fisler 1965). Their preferred habitats are the middle and upper portions of salt marshes; i.e., the pickleweed (*Salicornia virginica*) and peripheral halophyte zones and similar vegetation in diked wetlands adjacent to the bay (Shellhammer et al. 1982, 1988).

The Blacklock parcel has been flooded since late December 2005. Even before flooding, SMHM habitat was limited at Blacklock, and capture success has been fairly low, and decreasing yearly. DWR biologists estimated less than 10% (5-10 acres) of the total property was suitable SMHM habitat, and that existing habitat was of poor quality. Outside the pond, SMHM have been captured along the levee (in low numbers). These mice may be

primarily inhabiting the tidal fringe on the outside of the levee and using the levee as high tide refugia. Details of the 2003-2005 SHMH surveys are presented in Appendix A.

Several areas of the pond which are dominated by saltgrass have been surveyed with negative results. Since DWR acquired the parcel in 2003, most of the interior of the pond has been vegetated with tall emergents such as *Scirpus, Typha* and *Phragmites*. There is a great deal of perennial water in these areas which, coupled with the dense vegetation, has prevented surveying these areas. However, DWR and DFG biologists have conducted SMHM surveys in similar vegetation in other areas of the marsh, and these surveys have resulted in captures of no SMHM or single captures of one or two individuals.

Because the pond is flooded, the only potential habitat remaining on the property is the levees.

Environmental Consequences of the No Action

Under the no action alternative, DWR and USBR would not construct the levee breaches. The terrestrial habitat would continue to be managed for waterfowl, as in the past. There would be no change or impact to habitat conditions or amounts.

Environmental Consequences of the Proposed Action

Because the pond was flooded in December 2005, breaching the levee is expected to have no significant adverse impact on SMHM populations. Prior to flooding of the pond, based upon survey results and vegetation in which SMHM had been captured, it was estimated that there were only 5-10 acres of SMHM habitat within the pond. SMHM surveys from 2003-2005 showed a decreasing trend in SMHM numbers, indicating that the habitat was declining in suitability for the species, probably due to an increase in saltgrass and decrease in pickleweed.

After tidal action is restored to the area, mid- and high- marsh will develop in the pond, and there will be an increase in SMHM habitat, providing a significant benefit to the species.

After tidal inundation, SMHM trapping at Blacklock will be conducted annually, on any available habitat and will continue as habitat develops on the site. SMHM surveys will continue until survey results are stable.

Direct Effects

Because the pond was flooded during the winter of 2005/2006 and has remained flooded with 1-2 feet of water since then, all SMHM habitat within the pond is inundated. It is assumed that all SMHM that were resident within the pond were forced to higher ground by this flooding. Therefore, when the levee is breached, the introduction of tidal action is not expected to have an adverse impact on SMHM.

SMHM have been captured on the levee, so the breaching of the levee may impact SMHM and its habitat. To minimize or eliminate direct effects to SMHM, several actions will be taken prior to breaching the levee.

1. SMHM will be surveyed at the breach locations prior to excavation according to the protocol specified in DWR permit #835365-3 issued by USFWS. This permit authorizes DWR to conduct SMHM sampling within the Suisun Marsh. Surveys will be conducted for 7 consecutive days. If SMHM are present at specific breach locations:
    - The captured SMHM will be relocated to a suitable alternate location on the property and the USFWS will be immediately notified.
    - Surveys will continue until no SMHM are captured for 5 consecutive days.
    - Vegetation will then be hand-removed, followed by another trapping sequence.
    - Construction can commence after SMHM are NOT detected for 5 consecutive days after vegetation removal

2. Vegetation at breach locations will be removed by hand prior to breach construction even if SMHM are not detected by protocol surveys.

These actions should ensure that there are no SMHM within the area at the time of breaching, and that no SMHM are impacted by the excavation of the levee.

Indirect Effects
To avoid direct mortality to SMHM, the breach areas will be trapped and captured mice will be moved to suitable habitat along the Blacklock levee. In 2005 approximately 150 linear meters of the levee were trapped and only one SMHM was captured. The area trapped at the two breach locations will be smaller than the area trapped in 2005, so we expect to capture only 0-2 SMHM. Although these mice may experience some temporary indirect effects from being translocated to unfamiliar habitat, because so few are expected to be captured, we expect these indirect effects to be insignificant.

3.3.2.2 California clapper rail *Rallus longirostris obsoletus*

Affected Environment
The California clapper rail occurs primarily in emergent salt and brackish tidal marshlands of San Francisco Bay. Preferred habitat is subject to direct tidal circulation and is characterized by predominant coverage by pickleweed (*Salicornia virginica*) with extensive stands of Pacific cordgrass (*Spartina foliosa*) and, in the North Bay, *Scirpus robustus*, abundant high marsh cover, and an intricate network of tidal sloughs which provide abundant invertebrate populations (Harvey, 1988, Collins et al., 1994) as well as escape routes from predators (Zembal and Massey 1983, Foerster et al., 1990). DWR conducted clapper rail surveys throughout the marsh between 1991 and 1994. During this period, clapper rails were detected at several locations in the eastern marsh (DWR 1994). However, no rails were detected east of Suisun Bay. In 2005, DFG conducted California clapper rail surveys throughout the marsh. No clapper rails were detected in the vicinity of the action area (DFG 2004).

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches. Terrestrial habitat would continue to be managed for waterfowl, as in the past. There would be no change or impact to habitat conditions or amounts.

Environmental Consequences of the Proposed Action
Numerous surveys since 1979 have not found any clapper rails in or near the project area, so the project is expected to have no affect on this species

3.3.2.3 California black rail *Laterallus jamaicensis coturniculus*

Affected Environment
The California black rail prefers *Salicornia*-dominated marsh habitat (Cogswell and Christman, 1977). It is also known to occur in fresh, brackish, and salt marshes (Erhlich et al., 1988). In their survey of the San Francisco Bay during breeding seasons from 1986-88, Evens et al. (1991) found the birds occurred almost exclusively in marshlands with unrestricted tidal influence. This study found very few birds associated with diked wetlands, impounded, or partially tidal marshes. Moreover, Evens and his colleagues found that rails during the breeding season were almost exclusively associated with more mature, higher elevation marshes dominated by *Scirpus* and *Salicornia*. Breeding birds were often associated with marshes that had significant amounts of *Scirpus* spp. Subsequent field work indicates that seasonal wetlands with muted tidal flow, especially those adjacent to tidally

influenced marshes, may be utilized by rails in "wet" years when precipitation occurs late in the season and hydrates the substrate of marshes isolated from tidal influence, but supporting a dense cover of salt marsh vegetation; i.e., *Salicornia* (Evens, 1991). Black rail habitat is present in the area of the Blacklock restoration site, but no black rails have been identified in the action area. Black rail require well-vegetated high-marsh and marsh-upland transition zones. It is expected to take several years for this habitat to establish at the Blacklock restoration site. Monitoring for black rails will take place as part of the Blacklock project waterfowl and shorebird surveys.

Environmental Consequences of the No Action

Under the no action alternative, DWR and USBR would not construct the levee breaches. Terrestrial habitat would continue to be managed for waterfowl, as in the past. There would be no change or impact to habitat conditions or amounts.

Environmental Consequences of the Proposed Action

Direct Effects

The pond was flooded in December 2005, which negatively altered habitat occupied by California black rails. It is expected that water level changes brought about by breaching the levee will have no additional effects on California black rails. The species is not expected to nest within the pond now that it is flooded. The levee breach will be constructed in late summer or fall, after the nesting season, so construction equipment and related activities will not impact the reproduction of rails that may be resident in adjacent marshes.

Indirect Effects

Over time, as the pond accretes sediment, high- and mid- marsh will develop, increasing potential habitat for black rails.

3.3.2.4 Suisun ornate shrew *Sorex ornatus sinuosis*

Affected Environment

The Suisun shrew is a DFG species of Special Concern. It was formerly a category 2 federal candidate, but no longer has any federal status. The Suisun shrew is confined to tidal and brackish marsh communities of the north shores of San Pablo and Suisun bays, from Sonoma Creek, Sonoma County, on the west, eastward to about Collinsville, Solano County. Hays (1980) found that several vegetation types were used by shrews, but generally, they seemed to prefer clumps of *Salicornia* and *Jaumea* in the fall, and were most often found in *Triglochin* in the winter and early spring.

Environmental Consequences of the No Action

Under the no action alternative, DWR and USBR would not construct the levee breaches. Terrestrial habitat would continue to be managed for waterfowl, as in the past. There would be no change or impact to habitat conditions or amounts.

Environmental Consequences of the Proposed Action

Direct Effects

Because the pond was flooded during the winter of 2005/2006 and has remained flooded with 1-2 feet of water since then, any Suisun shrew habitat within the pond is inundated. The species is not known to inhabit the pond, but it is assumed that any shrews that were resident within the pond were forced to higher ground by this flooding. Therefore, when the levee is breached, the introduction of tidal action is expected to have no impact on Suisun shrew.

Indirect Effects
Over time, as high- and mid- marsh habitats develop, these areas may provide habitat for the shrew.

3.3.2.5 Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*

Affected Environment
The saltmarsh common yellowthroat is designated as a species of special concern by DFG and a federal species of concern by USFWS. Saltmarsh common yellowthroat use of habitat adjacent to the action area is unknown. Breeding surveys for saltmarsh common yellowthroat adjacent to the action area have not been conducted; however, the species typically prefers thick emergent vegetation for nesting and may be found within close proximity of the action area.

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches. Terrestrial habitat would continue to be managed for waterfowl as in the past. There would be no change or impact to habitat conditions or amounts.

Environmental Consequences of the Proposed Action
Direct Effects
The pond was flooded in December 2005, and it is expected that water level changes brought about by breaching the levee wound not result in substantial effects on saltmarsh common yellowthroats. The presence of water in the pond should not negatively impact this species as they nest off the ground in emergent or woody vegetation and feed on insects. The levee breach will be constructed in fall (September-October), after the yellowthroat nesting season, so construction equipment and related activities will not impact the reproduction of the species.

Indirect Effects
The flooding of the pond and introduction of tidal action is expected to have positive effects on the emergent plants in the pond, increasing potential nesting habitat for the species. Over time, as the pond accretes sediment, these emergent species will give way to higher marsh species such as pickleweed, decreasing nesting habitat.

3.3.2.6 Suisun song sparrow *Melospiza melodia maxillaris*

Affected Environment
In 1987 the USFWS received a petition to list the Suisun song sparrow as endangered. That request was deemed unwarranted, and threatened status was considered more appropriate. The Suisun song sparrow is currently a federal and State species of concern. The Suisun song sparrow is commonly seen foraging or roosting in the shrubs along the levees within Suisun Marsh. Suisun song sparrow use of habitat adjacent to the action area for breeding is unknown. The species typically prefers thick emergent vegetation on slough or bay margins for nesting so it is likely that it utilizes areas near the action area for nesting.

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches. Terrestrial habitat would continue to be managed for waterfowl, as in the past. There would be no change or impact to habitat conditions or amounts.

Environmental Consequences of the Proposed Action

Direct Effects

The pond was flooded in December 2005, which negatively impacted any habitat occupied by Suisun song sparrow, because this species feeds on the ground. Because feeding areas have decreased, it is possible that fewer Suisun song sparrows will now inhabit or nest within the pond. It is expected that water level changes brought about by breaching the levee will have no additional effects on Suisun song sparrows. The levee breach will be constructed in late summer or fall, after the nesting season, so construction equipment and related activities will not impact the reproduction of the species.

Indirect Effects

Over time, as the pond accretes sediment, water levels will decrease, high- and mid- marsh will develop, increasing habitat for Suisun song sparrows.

3.3.3 Wetland Plant Communities and Special Status Plants

The DFG, Wildlife Habitat Division conducted a comprehensive vegetation survey of Suisun Marsh in 1999. Change detection surveys were conducted in 2000 and 2003. A map representing vegetation conditions in June 2003 is presented as Figure 7 in the Appendix A. Vegetation (prior to inundation of the property) in the wetland consists primarily of tules (*Shoenoplectus acutus*), cattails (*Typha*) and saltgrass (*Distichlis spicata*), with some waterfowl food plants such as brass buttons (*Cotula coronopifolia*) and alkali bulrush *(Bolboschoenus maritimus)*. Currently, vegetation visible in the inundated pond is primarily tules, cattails and *phragmites*.

3.3.3.1 Mason's lilaeopsis *Lilaeopsis masonii*

Affected Environment

Mason's lilaeopsis is classified as a Category 2 candidate species, and is listed as rare under the California ESA. Mason's lilaeopsis is found in the intertidal zone of freshwater and brackish marshes of the San Francisco Estuary and Delta. Mason's lilaeopsis habitat is restricted to the littoral zone of freshwater and brackish marshes. It is most common on actively eroding slough banks, wave cut beaches, or earthen levees with a clay substrate. The habitat of Mason's lilaeopsis is transient and varies as a function of bank stability and changing water salinity. This species could potentially be found within the project action area, however the preferred breach locations are not actively eroding slough banks. An additional pre-project survey will be conducted and any potentially affected populations will be flagged and avoided.

Environmental Consequences of the No Action

Under the no action alternative, DWR and USBR would not construct the levee breaches and there would be no disturbance to wetland communities including Mason's lilaeopsis.

Environmental Consequences of the Proposed Action

Surveys for Mason's lilaeopsis would be conducted prior to construction although this species is not expected to be found at the preferred breach locations since they are not actively eroding slough banks. If this species is found, DWR would immediately consult with DFG and shift breach locations to avoid the species if possible.

3.3.3.2 Suisun marsh aster *Aster lentus*

Affected Environment

Suisun Marsh aster is a Category 2 candidate species for federal listing. The plant has no State status. USFWS uses the name *Aster chilensis* var. *lentus* for this species. Suisun Marsh aster is widely distributed throughout Suisun Marsh. It occurs along brackish sloughs and riverbanks influenced by tidal fluctuation. The species is most commonly found at or near the water's edge on the water side of Delta and Suisun Marsh levees.

Environmental Consequences of the No Action

Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to wetland communities including Suisun Marsh Aster.

Environmental Consequences of the Proposed Action

Field personnel have been directed to avoid areas where Suisun Marsh Aster is present or has been known to be present. An additional pre-project survey would be conducted and any potentially affected populations would be flagged. Because measures would be taken to avoid disturbance to Suisun Marsh aster habitat the project would not adversely affect the species. If pre-project surveys indicate that this species in within the breach location and cannot be avoided, DWR would immediately confer with USFWS biologists.

3.3.3.3 Delta tule-pea *Lathyrus jepsonii var jepsonii*

Affected Environment

Delta tule pea is classified as a Category 2 candidate species for federal protection under the ESA. It has no State of California status. Delta tule pea occurs on Delta islands of the lower Sacramento and San Joaquin rivers, westward through Suisun Bay, Suisun Marsh, Napa River marshes, and the wetlands surrounding south San Francisco Bay. The species has been identified within or near to the study. This robust perennial occurs along sloughs, riverbanks, and levees influenced by tidal fluctuation. The Delta tule pea is often observed near the water's edge on the outboard side of slough levees. It also occupies the channel banks of undiked tidal marshes. Suisun Marsh populations are often observed partially inundated at high tide.

Environmental Consequences of the No Action

Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to wetland communities including Delta tule-pea.

Environmental Consequences of the Proposed Action

Field personnel have been directed to avoid areas containing populations of Delta-tule pea or areas where the species has been known to be present. A pre-project survey would be conducted within the action area, and any potentially affected populations will be flagged. If pre-project surveys indicate that this species in within the breach location and cannot be avoided, DWR will immediately consult with USFWS biologists.

3.3.3.4 Suisun thistle *Cirsium hydrophilum* var. *hydrophilum*

Affected Environment

Suisun thistle is listed an endangered under the federal ESA, and is a species of Concern in California. The thistle is endemic to Suisun Marsh. Historic regional floras and herbarium records suggest that it never occurred outside of Suisun Marsh. Suisun thistle is limited to the banks of small first order tidal channels in the upper

elevational zones of natural tidal marsh habitat. It is also found along mosquito recirculation ditches in high marsh zones.

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to wetland communities.

Environmental Consequences of the Proposed Action
This species is not known to occur within the action area. Project activities are therefore unlikely to disturb Suisun thistle populations.

3.3.3.5 Soft bird's beak *Cordylanthus mollis mollis*

Affected Environment
Soft bird's beak is listed as Endangered under the federal ESA, and as a rare plant under the California ESA. This rare plant is endemic to the San Francisco Estuary and its current range is restricted to occurrences within Suisun Marsh, Contra Costa shoreline tidal marshes of Suisun Bay, Napa Marsh, and west to marshes near Point Pinole. Soft bird's beak is restricted to a narrow lower high intertidal zone of fully tidal or muted tidal marsh. This species is not known to occur within the action area.

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to wetland communities.

Environmental Consequences of the Proposed Action
This species is not known to occur within the action area. Project activities are therefore unlikely to disturb Soft bird's beak populations.

3.3.4 Fish and Aquatic Special-Status Species

Three locations within the property were beach seined on August 25, 2004 to evaluate pre-project fish presence and diversity within the pond. At the sites seined, water depth varied from 0.3 to 3.0 feet. Seining was done days before the culvert was re-opened following the end of the Chinook salmon closure period. Three locations were chosen for sampling according to a likelihood of catch and for their accessibility. A beach seine was used to span the channel and corral fishes present to the bank where individuals were placed into a holding bucket for identification.

Native and introduced species were captured at all three locations. Native fishes caught include tule perch (*Hysterocarpus traskii traskii),* prickly sculpin (*Cottus asper*), three-spine stickleback (*Gasterosteus aculeatus)* and Sacramento blackfish (*Orthodon microlepidotus*). Black crappie (*Pomoxis negromaculatus)*, Shimofuri gobi (*Tridentiger bifasciatus*), inland silversides (*Menida beryllina*), mosquito fish (*Gambusia affinis*), brown bullhead (*Ictalurus nebulosus*), carp (*Cyprinus carpio*) and American shad (*Alosa sapidissima*) comprise the introduced species sampled. Temperature, D.O. and E.C. were recorded prior to seining for each site. Numerous *Palaeomon* shrimp, crayfish and other invertebrates were also observed. Survey locations and detailed results are presented in Table 2 of Appendix A.

3.3.4.1 Central Valley steelhead *Oncorhynchus mykiss*

Affected Environment

The Central Valley steelhead was listed as a threatened species by NMFS on December 23, 2005. The Central Valley steelhead Evolutionarily Significant Unit (ESU) occupies the Sacramento and San Joaquin rivers and their tributaries (SEW 2001). There are two races of steelhead, winter steelhead and summer steelhead. Rivers of the Central Valley contain only winter steelhead (Moyle 2002). Winter steelhead start entering freshwater in August, with a peak in late September-October, after which they wait until flows are high enough in tributaries to enter for spawning (Moyle 2002). Spawning begins in late December and can extend into April (SEW 2001).

Adult steelhead may be expected to move past the project area from August to March. They may potentially run up into Montezuma and Nurse sloughs. During monthly sampling between 1980 and 2005 UC Davis captured 5 steelhead in the vicinity of Blacklock. All fish were adults and were captured between December and February (BDAT 2006). No steelhead were captured anywhere in the marsh during the month of September (proposed construction period), thus it is reasonable to assume steelhead will not be present at the project site during September. No steelhead were observed in the Blacklock site itself during the 2004 beach seining.

Environmental Consequences of the No Action

Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to central valley steelhead.

Environmental Consequences of the Proposed Action

No steelhead were observed within Blacklock during the DWR seining in 2004. As discussed previously, it appears that Central Valley steelhead are not present in sloughs adjacent to the project area during September. Effects of the action may include temporary displacement of fish from preferred habitat. However, this effect is anticipated to be insignificant because it is minimal in magnitude (one tidal cycle, low volume of water exchange relative to that of Little Honker Bay) and discountable because the probability of steelhead presence is extremely low within the action area. Because project effects are expected to be insignificant and discountable, it is our determination that this project is not likely to adversely affect Central Valley steelhead.

3.3.4.2 Central Valley spring-run Chinook salmon *Oncorhynchus tshawytscha*

Affected Environment

The Central Valley spring-run chinook salmon was listed as threatened by NMFS on September 9, 1999 and by the California Fish and Game Commission on February 5, 1999. Spring-run chinook salmon are found Central Valley streams as well as other streams in Oregon, Washington and California. Adult spring run migrate through Montezuma Slough or Suisun Bay from February through June, with the peak migration occurring in May (SEW 2001). Spring-run juveniles typically occur in the marsh over a number of months, including December through May (SEW 2001).

No chinook salmon were captured within Blacklock during beach seining in 2004. Between 1980 and 2005, UC Davis' monthly sampling at four current, and two historical locations near Blacklock, resulted in the capture of 169 chinook salmon. Only two of the salmon were caught in Nurse Slough, with the remainder caught in Denverton slough, upstream of the project site. All of the salmon were caught between December and April. The race of salmon was not identified. In twenty-three years of sampling, no chinook salmon have been caught in the vicinity of Blacklock during the month of September. Thus, it is reasonable to assume that chinook salmon will not be present at the breach locations in September.

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to spring- run chinook salmon.

Environmental Consequences of the Proposed Action
No chinook salmon were observed within Blacklock during the DWR survey in 2004. As discussed previously, it appears that spring-run chinook salmon are not present in sloughs adjacent to the project area during September. Effects of the action may include temporary displacement of fish from preferred habitat. However, this effect is anticipated to be insignificant because it is minimal in magnitude (one tidal cycle, low volume of water exchange relative to that of Little Honker Bay) and discountable because the probability of spring-run chinook salmon presence is extremely low within the action area. Because project effects are expected to be insignificant and discountable, it is our determination that this project is not likely to adversely affect spring-run chinook salmon.

3.3.4.3 Winter-run chinook salmon *Oncorhynchus tshawytscha*

Affected Environment
The winter-run chinook salmon was listed as endangered by NMFS on March 23, 1994 (formerly listed as threatened by NMFS) and by the California Fish and Game Commission on September 22, 1989. Winter-run spawning occurs from late-April to early-August, peaking in May and June (Moyle 2002). Winter-run fry begin out-migrating from the spawning areas in early September. Recent studies suggest that a majority of young winter-run salmon may remain in the river until February and March (Brown and Greene 1992).

No chinook salmon were captured within Blacklock during beach seining in 2004. Between 1980 and 2005, UC Davis' monthly sampling at four current, and two historical locations near Blacklock, resulted in the capture of 169 chinook salmon. Only two of the salmon were caught in Nurse Slough, with the remainder caught in Denverton slough, upstream of the project site. All of the salmon were caught between December and April. The race of salmon was not identified. In twenty-three years of sampling, no chinook salmon have been caught in the vicinity of Blacklock during the month of September. Thus, it is reasonable to assume that chinook salmon will not be present at the breach locations in September.

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore no disturbance to winter run chinook salmon or winter run chinook salmon critical habitat would occur.

Environmental Consequences of the Proposed Action on Winter-Run Chinook Salmon
No chinook salmon were observed within Blacklock during the DWR survey in 2004. As discussed previously, it appears that winter-run chinook salmon are not present in sloughs adjacent to the project area during September. Effects of the action may include temporary displacement of fish from preferred habitat. However, this effect is anticipated to be insignificant because it is minimal in magnitude (one tidal cycle, low volume of water exchange relative to that of Little Honker Bay) and discountable because the probability of winter-run chinook salmon presence is extremely low within the action area. Because project effects are expected to be insignificant and discountable, it is our determination that this project is not likely to adversely affect winter-run chinook salmon.

Environmental Consequences of the Proposed Action on Winter-Run Chinook Salmon Critical Habitat
No designated critical habitat of the winter-run chinook salmon will be impacted by this project.

3.3.4.4 Delta smelt *Hypomesus transpacificus*

Affected Environment

The delta smelt was listed as threatened by USFWS on March 5, 1993 and by the California Fish and Game Commission on December 9, 1993. No delta smelt were captured in Blacklock during beach seining in 2004. UC Davis conducts monthly (adult and juvenile) fish sampling throughout Suisun Marsh. Four sites are currently located in sloughs adjacent to Blacklock, two in Nurse Slough and two in Denverton Slough. Data also exists for two historical sampling sites in Montezuma Slough at the confluence with Nurse Slough. Between 1980 and 2002, 96 delta smelt were captured at the six locations. All but nine were captured between November and April, and only two were captured in September. No delta smelt were captured near Blacklock in 2003-2005. Between 1994 and 1998 larval fish were collected in April through June at the above mentioned sites. A total of 296 larval delta smelt were collected. In twenty-three years of sampling, only two delta smelt have been caught in the vicinity of Blacklock during the month of September. Thus, it is reasonable to assume that if delta smelt are present at the breach locations in September, they are in extremely low numbers, and are adult fish, more capable of responding to changing ambient conditions.

Environmental Consequences of the No Action

Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to delta smelt or delta smelt critical habitat.

Environmental Consequences of the Proposed Action on Delta Smelt

No delta smelt were observed within Blacklock during the DWR survey in 2004. As discussed previously, it appears that delta smelt are not present in sloughs adjacent to the project area during September. However, it is possible that delta smelt are present in extremely low numbers near the proposed action area based upon their confirmed presence in Montezuma Slough in September 1980. The proposed action may result in water with low dissolved oxygen being released into Little Honker Bay at the time of construction. Effects of the action may include temporary displacement of fish from preferred habitat. However, this effect is anticipated to be insignificant because it is minimal in magnitude (one tidal cycle, low volume of water exchange relative to that of Little Honker Bay) and discountable because the probability of delta smelt presence is extremely low within the action area. Because project effects are expected to be insignificant and discountable, it is our determination that this project is not likely to adversely affect delta smelt.

Implementation of the proposed project may provide additional habitat for delta smelt and may result in long-term benefits to the species.

Environmental Consequences of the Proposed Action to Delta Smelt Critical Habitat

Delta smelt critical habitat encompasses the entire legal Sacramento San-Joaquin Delta, Suisun Bay, and Suisun Marsh. Construction activities may result in temporary disturbance to the critical habitat, including increased turbidity, increased noise, and reduced water quality. However, effects are anticipated to be limited to one tidal cycle. All construction activities will be limited to time periods when delta smelt larvae, juveniles, and adults are rarely present. This project will not result in permanent loss or impact to critical delta smelt habitat.

3.3.4.5 Green Sturgeon *Acipenser medirostris*

Affected Environment

The green sturgeon was listed as threatened by NMFS on April 7, 2006. The listing became effective on July 6, 2006. The green sturgeon occurs in the Pacific from the Bering Sea to Ensenada, Mexico (Moyle 2002). On the west coast of North America, it is found in the lower reaches of larger rivers, from British Columbia to the

Sacramento River (Moyle 2002). The principal spawning streams are the Rogue River, Klamath River Basin and Sacramento River (NMFS 2006). No green sturgeon were caught within Blacklock during DWR's 2004 seining. However, sturgeon have very low vulnerability to beach seines. Green sturgeon have been captured in low numbers in Suisun and Grizzly Bays. The USFWS has been conducting juvenile chinook salmon monitoring at Chipps Island since 1983. Over 30,000 samples have been collected at three sites near Chipps Island and only 16 green sturgeon have been captured (BDAT 2006). UC Davis sampling has captured only 3 green sturgeon in the marsh, none of which were captured in the vicinity of Blacklock (BDAT 2006).

Environmental Consequences of the No Action

Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to green sturgeon.

Environmental Consequences of the Proposed Action on Delta Smelt

No green sturgeon were observed within Blacklock during the DWR seining in 2004. As discussed in the affected environment, it appears that green sturgeon are not common in sloughs adjacent to the project area. Effects of the action may include temporary displacement of fish from preferred habitat. However, this effect is anticipated to be insignificant because it is minimal in magnitude (one tidal cycle, low volume of water exchange relative to that of Little Honker Bay) and discountable because the probability of green sturgeon presence is extremely low within the action area. Because project effects are expected to be insignificant and discountable, it is our determination that this project is not likely to adversely affect green sturgeon.

3.3.4.6 Northern anchovy Essential Fish Habitat *Engraulis mordax*

Affected Environment

Northern anchovy do not have status under the federal ESA. Essential fish habitat for northern anchovy is protected under the Magnuson-Stevens Fishery Management and Conservation Act. Northern anchovy are pelagic marine fish occasionally found within Suisun Marsh during pronounced salinity intrusion events during droughts and low outflow periods. Northern anchovy are typically found in waters ranging from 12 to 21.5 degrees Centigrade. Preferred Northern anchovy habitat includes off-shore pelagic marine environments.

Environmental Consequences of the No Action

Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to northern anchovy EFH.

Environmental Consequences of the Proposed Action

The action area does not include areas of quality habitat for the Northern anchovy. Therefore, project activities would not disturb Northern anchovy EFH.

3.3.4.7 Pacific sardine Essential Fish Habitat *Sardinops sagax*

Affected Environment

Pacific sardines do not have status under the federal ESA. EFH for Pacific sardines is protected under the Magnuson-Stevens Fishery Management and Conservation Act. Pacific sardines are pelagic marine fish occasionally found within Suisun Marsh during pronounced salinity intrusion events during droughts and low outflow periods. Sardines are typically found in waters ranging from 12 to 21.5 degrees Centigrade. Preferred Pacific sardine habitat includes off-shore pelagic marine environments.

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to pacific sardine EFH.

Environmental Consequences of the Proposed Action
The action area does not include areas of quality habitat for the Pacific sardine. Therefore, project activities would not disturb Pacific sardine essential fish habitat.

3.3.4.8 Fall-run and late-fall run chinook salmon Essential Fish Habitat *Oncorhynchus tshawytscha*

Affected Environment
Fall-run and late-fall run chinook salmon do not have status under the federal ESA. EFH for fall-run and late-fall run chinook salmon is protected under the Magnuson-Stevens Fishery Management and Conservation Act. Fall-run chinook salmon enter fresh water in the Sacramento River and begin spawning in October. Late-fall run chinook salmon move upstream October through February and begin spawning in January. Migrating fall-run adults could occur in the marsh June through December, while juveniles may be present from January through July; peak occurrence is February through mid-May. Fall-run chinook adults migrate through the marsh between June and December using Montezuma Slough and the Sacramento River.

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore no disturbance to fall-run and late fall run chinook salmon EFH.

Environmental Consequences of the Proposed Action
Fall-run and late-fall run chinook salmon may to be in the vicinity of the action area during construction of the levee breaches. Effects of the action may include temporary displacement of fish from preferred habitat. However, this effect is anticipated to be insignificant because it is minimal in magnitude (one tidal cycle, low volume of water exchange relative to that of Little Honker Bay). Implementation of the proposed project may provide additional habitat for late fall run chinook salmon and may result in long-term benefits to the species.

3.3.4.9 Starry flounder Essential Fish Habitat *Platichthys stellatus*

Affected Environment
Starry flounder do not have status under the federal ESA. EFH for starry flounder is protected under the Magnuson-Stevens Fishery Management and Conservation Act. Starry flounder, relatively uncommon in the Delta and Suisun Marsh, are found elsewhere throughout the San Francisco Estuary. This species prefers sandy or muddy stream bottoms within the Estuary, and are most abundant in wet years with high outflows. By July and August most of the young-of-the-year have moved into areas of higher salinity (10-15 ppt), above that range normally found in Suisun Marsh.

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to starry flounder EFH.

Environmental Consequences of the Proposed Action
Starry flounder is uncommon in the Marsh, and the action area does not include areas of quality habitat for therefore, the project not expected to have any effect on starry flounder EFH.

3.3.4.10 Western Pond Turtle *Clemmys marmorata*

Affected Environment
The western pond turtle is designated as a species of special concern by DFG and a federal species of concern by USFWS. Western pond turtles have been observed along sloughs and waterways throughout the Suisun Marsh. In the managed wetlands Western pond turtles are seen primarily during spring drawdown, basking on pipes or debris in the larger drainage ditches (Steve Chappell, SRCD, pers. comm.). It is not known where the turtles overwinter in the marsh, where they nest, or favored habitats of hatchlings and juveniles.

During site visits by DWR biologists to the action area, adult Western pond turtles have been observed in other locations of the action area, basking in the circulation ditches.

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches and therefore there would be no disturbance to western pond turtles.

Environmental Consequences of the Proposed Action
The proposed project may cause some temporary disturbance to Western pond turtles if they are basking near the preferred breach locations. However, any disturbance would be temporary at most since turtles will move to other basking sites, or return to the original site once DWR personnel have left the area. If a western pond turtle is observed, it will be left alone to move out of the area on its own. If it doesn't move on its own, it will be relocated by a biologist at least 200 meters away from the project location. During construction there could be some temporary increase in turbidity which may affect Western pond turtles locally. Turbidity effects would be short-lived and would not have lasting effects on Western pond turtles. Restoration of this property may provide additional habitat and thus have long-term net benefits to the species.

3.3.5 Water Quality

Affected Environment
Water quality changes, specifically changes in salinity and the production of methyl mercury, resulting from tidal inundation at Blacklock are of particular interest to DWR and other agencies involved in long term planning decisions in Suisun Marsh.

DWR has installed a monitoring station (BLL) adjacent to the proposed restoration site and will continue to collect salinity and weather data. A pressure transducer is installed in the borrow ditch to measure water levels inside the property. Pre-project methyl mercury samples were collected by DFG in January 2004 following levee overtopping.

Environmental Consequences of the No Action
DWR and USBR would not construct the levee breaches. Therefore, there would be no effect to existing water quality conditions and water quality studies would not be completed.

Environmental Consequences of the Proposed Action

With implementation of the proposed action, DWR, DFG, and USGS can continue collaborating on an interdisciplinary study to characterize changes in hydrodynamics, sediment, chlorophyll, and methylmercury dynamics in the Nurse/Denverton Slough complex as a result of inundation of the Blacklock property. The purpose of this study is to observe changes in these quantities due to the impending levee breach at Blacklock. Dissolved oxygen, temperature, and EC will be collected within the restoration site as part of the fish monitoring program. As part of comprehensive water quality sampling program described in Appendix A, DFG is developing specific study protocol for investigating methyl mercury exports and methyl mercury in sediments at Blacklock.

Hydrodynamic modeling conducted by DWR has suggested that breaching levees in Suisun has an effect on salinities both in Suisun Marsh and in the Sacramento San Joaquin Delta. The specific effects are dependent on the size and location of the breach and the area of inundation. Modeling of the Blacklock restoration shows changes in salinity in Montezuma Slough, both upstream and downstream of Nurse Slough. These changes were minor and are not expected to impact the ability to meet SWRCB salinity standards for Suisun Marsh. This is discussed in more detail in the "Draft Restoration Plan for the Blacklock Restoration Project" (Appendix A).

A constructed levee breach may result in water with low dissolved oxygen levels flowing into the adjacent water ways at the time of the breaches. The effects of the action are anticipated to be insignificant because they are minimal in magnitude (low volume of water exchange relative to that of Little Honker Bay) and temporary as the full exchange should be complete within one tidal cycle. The volume of water flowing out of the property is much less than that of Little Honker Bay, the receiving waters.

If an unintended levee breach occurs, the effects of this action are expected to be insignificant because an unintended levee breach is likely to be smaller (initially) and exchange less water each tidal cycle.

3.3.6 Air Quality

Affected Environment

The project area is within the Bay Area Air Quality Management District (BAAQMD). The District's jurisdiction encompasses southwestern Solano and southern Sonoma counties and all of Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara and Napa counties. All rules and regulations of the district will be followed. Air quality is generally good as the wind blows nearly every day in Suisun Marsh (Suisun- the Native American name for "west wind". BAAQMD reports for Fairfield indicate no exceedences for ozone in the past three years, 2001-2003 (BAAQMD, 1993). There are no data available from the Fairfield station on carbon monoxide, nitrogen dioxide, sulfur dioxide and particulate matter. An increase in development adjacent to Suisun Marsh, and associated vehicular traffic may affect ozone and other air quality parameters in the future.

Environmental Consequences of the No Action

DWR and USBR would not construct the levee breaches. Therefore, there would be no effect to air quality

Environmental Consequences of the Proposed Action

Implementation of the proposed project would require the use of an excavator for 2-4 days, 6 hours per day. The potential impacts associated with this activity are considered less than significant.

3.3.7 Cultural Resources

Affected Environment

DWR conducted a cultural resources record search at the Northwest Information Center of the California Historical Resources Information System at Sonoma State University as part of the phase I environmental site assessment in January 2003. A search of the records maintained did not identify any previously recorded cultural resources in the project area or vicinity, nor have any cultural resources studies previously been conducted in the project area. Contact with the Native American Heritage Commission and local Native American representatives failed to identify the presence of any traditional cultural properties or sacred sites within the proposed project acreage.

A cultural resources site inspection was conducted by Janis Offerman of DWR on January 4, 2005. Ms. Offerman concluded that the proposed project area does not appear sensitive for cultural resources.

Environmental Consequences of the No Action

DWR and USBR would not construct the levee breaches. Therefore, there would be no effect to cultural resources.

Environmental Consequences of the Proposed Action

Since no known artifacts and historic properties are known to be located on the Blacklock restoration site, it is unlikely that implementation of the proposed project would result in impacts to cultural resources. If artifacts are found during construction of the levee breaches, all work would cease until the objects were evaluated by qualified personnel.

3.3.8 Indian Trust Assets

Affected Environment

Indian Trust Resources (ITRs) are legal interests in property or rights held in trust by the United States for Indian Tribes or individuals. Indian reservations, rancherias, and allotments are common ITRs. Other ITRs include traditional use areas. No ITRs have been identified at the property

Environmental Consequences of the No Action

Since there are no ITRs in or near the Blacklock restoration site, there would be no impact to Indian Trust Assets under no action alternative.

Environmental Consequences of the Proposed Action

Since there are no ITRs in or near the Blacklock restoration site, the proposed action would not impact ITRs.

3.3.9 Environmental Justice

Affected Environment

Executive Order 12898 requires each Federal Agency to identify and address disproportionately high and adverse human health or environmental effects, including social and economic effects of its program, policies, and activities on minority populations and low-income populations.

Environmental Consequences of the No Action
Since under the no action alternative, DWR and USBR would not construct the levee breaches, there would be no adverse human health or environmental effects to minority or low-income populations.

Environmental Consequences of the Proposed Action
Constructing levee breaches and restoring tidal action to this location would not result in adverse human health or environmental effects to minority or low-income populations because there are no low income or minority populations in the area and there would be no adverse health effects associated with the proposed action.

3.3.10 Recreation

Affected Environment
Public access has been restricted within the project area. Vehicular access to the site requires driving through private property. DWR has an easement to access the site for scientific or management purposes, but this easement is not for public access. A private boat launch is located along Denverton Slough, north of the proposed breach location at stn 55+00. Little Honker Bay and the adjacent sloughs are used year-around for boating and fishing.

Environmental Consequences of the No Action
Under the no action alternative, DWR and USBR would not construct the levee breaches. There will be no change in public accessibility to the action area.

Environmental Consequences of the Proposed Action
Construction of the levee breaches would provide access via boat to this project area.
Several 'No Trespassing' signs have been installed along the exterior levee to discourage the public from accessing the site by boat. Limiting public access would be more difficult to enforce once the site is open to tidal action. However, DWR will continue to discourage public access due to liability concerns and for the protection of sensitive species. Additional "No Trespassing" signs will be installed at the breach locations.

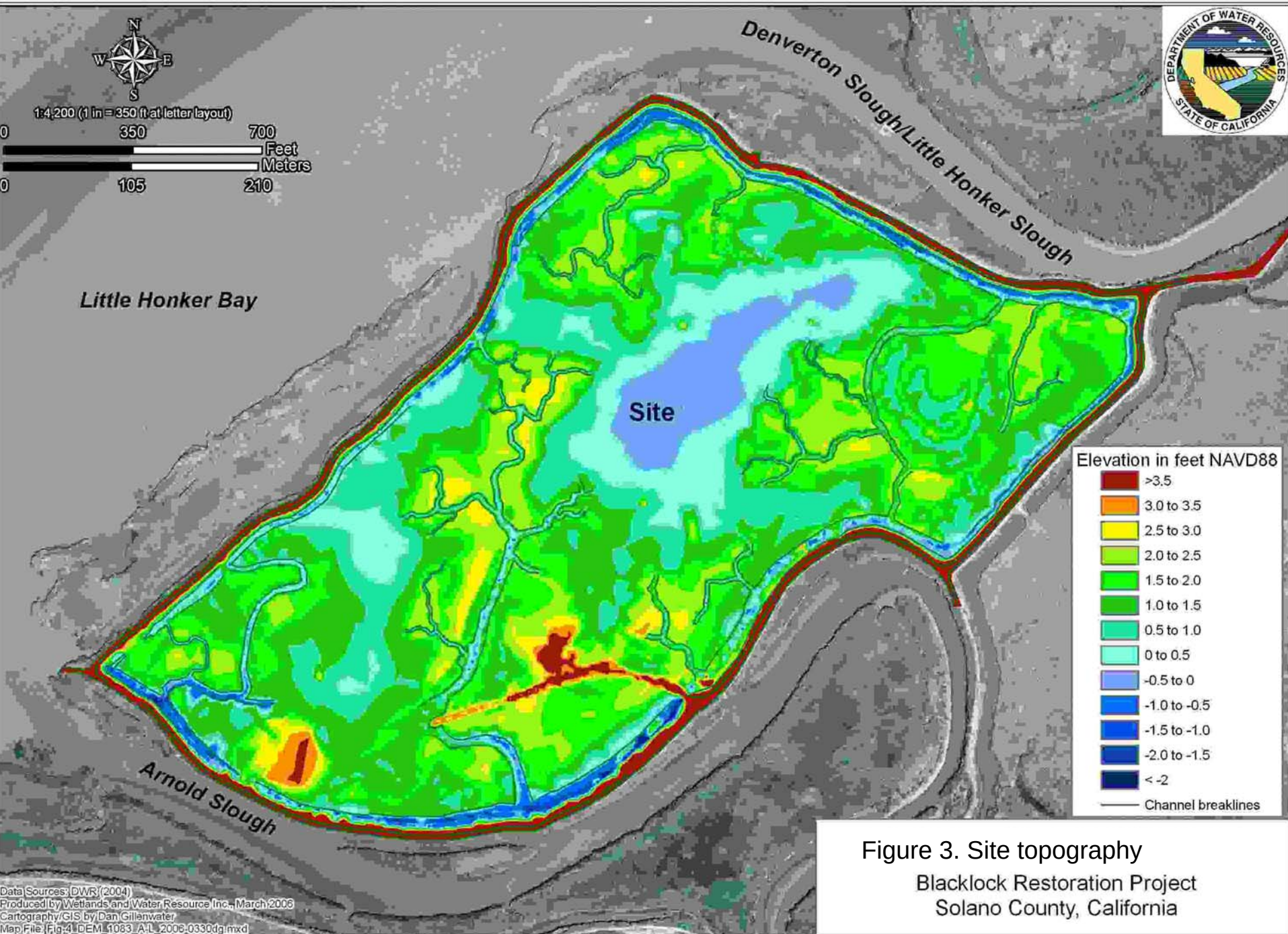


Figure 3. Site topography

Blacklock Restoration Project
Solano County, California

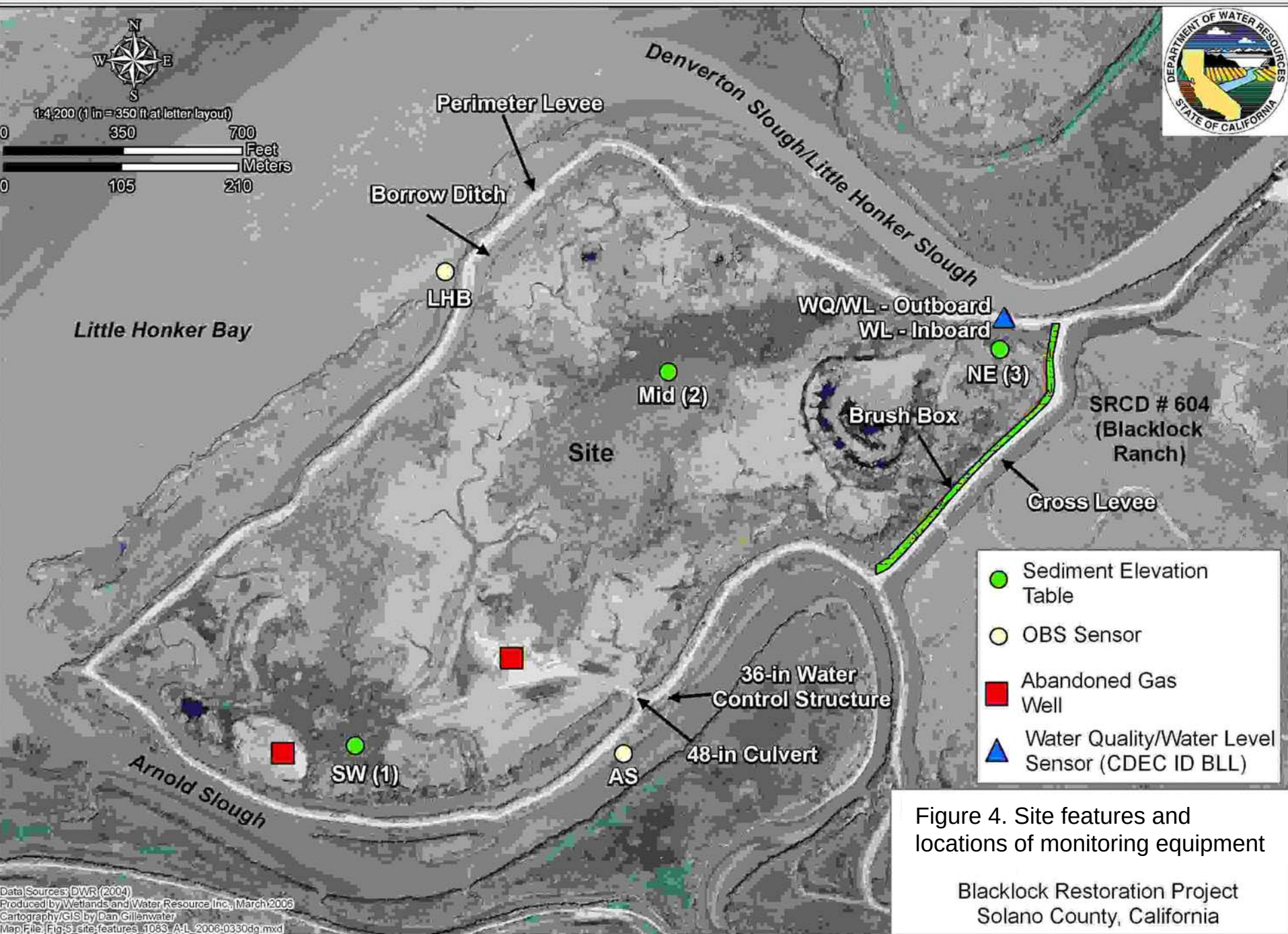


Figure 4. Site features and locations of monitoring equipment

Blacklock Restoration Project
Solano County, California

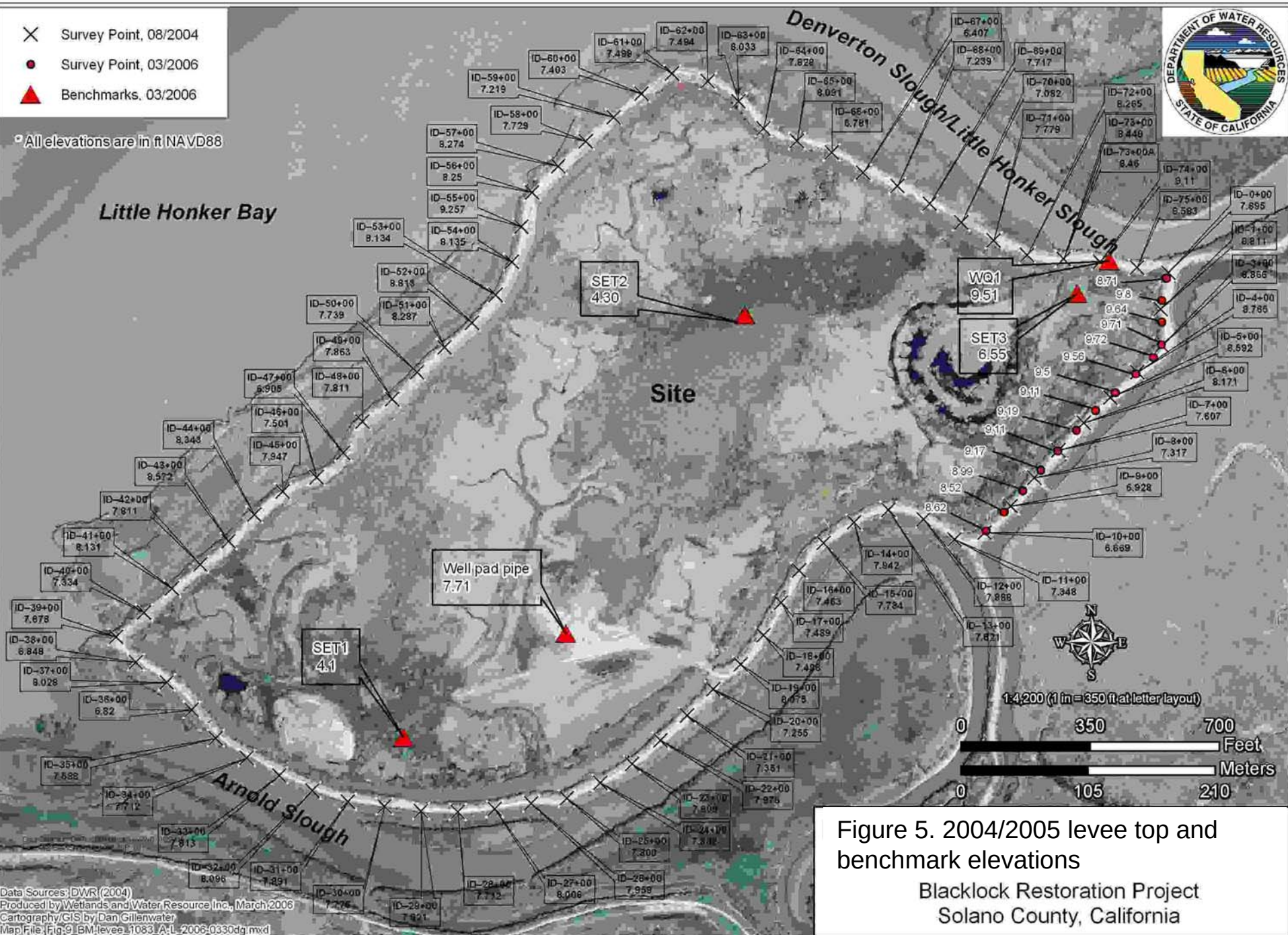


Figure 5. 2004/2005 levee top and benchmark elevations

Blacklock Restoration Project
Solano County, California

4.0 CUMULATIVE IMPACTS

No significant adverse cumulative impacts are expected to occur as a result of simultaneous implementation of the Blacklock Restoration Project and the projects discussed below. Positive cumulative impacts include an increase in the quantity and quality of wetland habitat and improved protection of special-status species and their habitats.

Several groups have recently recommended that some of the land in Suisun Marsh be restored to tidal action. These groups include The Goals Project and CALFED (including the Suisun Charter Group). The Recovery Plan for SMHM also recommends tidal marsh creation for the recovery of the species. In addition to the plan to restore tidal action to Blacklock, there are currently three other projects that will create tidal marsh habitat in Suisun Marsh (Montezuma Wetlands, Hill Slough West, Meins Landing)

Together, these projects are expected to create emergent, high and mid marsh habitats appropriate for native species, including listed and sensitive species. In addition to creating habitat, the areas restored to tidal marsh will experience less human disturbance than managed wetland, improving habitat value for any species occupying the restored marsh habitats.

4.1 Habitat Management, Preservation, and Restoration Plan for the Suisun Marsh

The proposed "*Habitat Management, Preservation, and Restoration Plan for the Suisun Marsh"* (SMP) is being developed by the Suisun Marsh Charter Group, a collaborative effort among federal, State and local agencies with primary responsibility for actions in Suisun Marsh. The Charter Group was formed in 2001 to resolve issues including, but not limited to: amending the SMPA, obtaining a Regional General Permit for maintenance activities, implementing the Suisun Marsh Levee Program, and contributing to the recovery of endangered species.

The Charter Group was charged with developing a regional plan that would outline the actions needed in Suisun Marsh to preserve and enhance managed seasonal wetlands, restore tidal marsh habitat, implement a comprehensive levee protection/improvement program, and protect ecosystem and drinking water quality. The proposed SMP would balance implementation of the CALFED Program, Suisun Marsh Preservation Agreement, and other management and restoration programs within Suisun Marsh in a manner responsive to the concerns of stakeholders and based upon voluntary participation by private land owners. The proposed SMP also would provide for simultaneous protections and enhancement of: (1) the Pacific Flyway and existing wildlife values in managed wetlands, (2) endangered species, (3) tidal marshes and other ecosystems, and (4) water quality, including, but not limited to, the maintenance and improvement of levees.

The Charter Group initiated a formal NEPA/CEQA planning process in 2003. A series of public scoping meetings were held in November and December 2003 and a Scoping Report was distributed in May 2004. The Group is currently developing alternatives as part of a Programmatic Environmental Impact Report/Statement. The Charter Group is integrating science throughout the planning and implementation process.

4.2 Montezuma Wetlands Project

The Montezuma Wetlands Project (MWP) plans to restore about 1,800 acres of tidal and seasonal wetlands in San Francisco Bay near the mouth of the Sacramento River using about 20 million cubic yards of non-hazardous sediment to be dredged from the shipping channels and ports in San Francisco Bay. Over several years, the site will be restored in phases, to a tidal and seasonal marsh through engineering, channeling, and contouring.

The 1,800-acre MWP site occupies the eastern side of Suisun Marsh, adjacent to Montezuma Slough between Birds Landing and Collinsville, in Solano County. The land is privately owned by Levine-Fricke Restoration Corporation and is within the jurisdiction of SRCD. Although used mostly for grazing, with some recreation and industry, about 1,500 acres of the MWP is designated for Marsh protection. The other 300 acres now designated by the BCDC for industry, will be permanently removed from potential industrial use and restored as tidal and seasonal wetlands.

Dredge material is transported to the site via barge, and then the sediment is pumped as slurry to the placement area. Once the sediment is in place, it is decanted and reshaped. Soil and water quality data indicate that MWP will not affect groundwater resources, and initial modeling results conducted by a private contractor for the environmental documentation indicate the project will not affect surface water salinity in Suisun Marsh. Proponents of the MWP claim that the project will benefit fish and wildlife resources by restoring wetland habitat and will enhance water quality, since wetlands function as a natural purification mechanism.

In December 2003 the project began to receive and place sediment. As of 2004, more than 500,000 cubic yards have been placed into Cells 1 and 2 in Phase 1. Project proponents are currently preparing additional areas of Phase I to receive an additional 1.5 million cubic yards of sediment. Completion of the additional Phases is expected to take several years.

4.3 Hill Slough West Tidal Restoration Project

The Hill Slough West Habitat Restoration Demonstration Project will restore tidal wetlands and moist grassland (alluvial) habitat to approximately 200 acres of diked seasonal and perennial wetlands in northern Suisun Marsh, Solano County, California. The site is part of the Hill Slough Wildlife area, owned and managed by DFG.

The Hill Slough West project site is a former tidal brackish marsh and lowland alluvial habitat along the northern margin of Suisun Marsh. The site currently supports seasonally ponded and perennial wetlands and non-native grasslands. Unscreened culverts provide limited site drainage to an adjacent tidal channel. Hardstem bulrush and cattail occur on the bayside of the outboard levee separating the project site from the adjacent slough. Areas inside the levee support a variety of wetland plants, including pickleweed, several species of bulrush, salt grass, alkali heath, and several species of rushes. The site supports limited wetland-associated wildlife such as waterfowl, wading birds, and the endangered SMHM. Much of the site has subsided from historic marshplain elevations.

The wetland restoration will re-introduce tidal action to the site, restoring a transition of perennial aquatic habitat in the deepest areas, low intertidal marsh, high intertidal marsh, and lowland alluvial habitat. The desired outcome is a self-sustaining marsh ecosystem created through restoration of natural hydrologic and sedimentation processes and reliance on natural abiotic and biological succession processes.

DFG was awarded CALFED funds for restoration planning in 1998 and received subsequent funding in 2001 for the environmental documentation and permitting. Phillip Williams and Associates completed a restoration plan for the project in September, 2001. DFG is currently working on the environmental documentation and permitting for the project. The JARPA permit package has been submitted and the CEQA document is near completion. DFG hopes to implement the restoration in Summer 2007.

4.4 Meins Landing Tidal Restoration Project

The DWR, Delta Levees Branch acquired the Meins Landing Duck Club in December 2005 and are proposing to restore the area to tidal wetlands. Meins Landing is a 668 acre managed marsh in Suisun Marsh, Solano County. DWR proposes to convert it into tidal wetlands. DWR plans to designate some of the restoration as mitigation for impacts to the state and federally-listed endangered SMHM from DWR's proposed project to raise the levees on Van Sickle Island. Meins Landing is a mosaic of wetlands and uplands that could provide a diversity of habitats when restored. The site is currently leveed and managed as seasonally flooded wetlands used for waterfowl hunting.

The project could enhance the existing pickleweed acreage and convert some of the weedy areas into brackish and salt marsh dominated by pickleweed or other emergent species. Conversion of less desirable non native dominated sites to tidal marsh and transitional uplands will likely increase the overall value of Meins Landing for native species such as SMHM and burrowing owl.

4.5 Suisun Marsh Land Acquisition and Tidal Marsh Restoration Project

In 2003, CALFED awarded a grant of $1,046,400 for land acquisition in Suisun Marsh. This proposal, Suisun Marsh Land Acquisition and Tidal Marsh Restoration Project, was submitted by the USFWS with collaboration with the Suisun Marsh Charter Group. DFG Central Valley Bay-Delta Branch has assumed the lead on this project.

DFG, with the assistance of an Advisory Team, is working on developing contract language, and ensuring a realistic budget for the State land acquisition process. To date, a site has not been selected for acquisition and a contract is not in place with the CDBA.

4.6 USFWS Tidal Marsh Recovery Plan

USFWS is revising the 1984 SMHM and CCR endangered species recovery plan. The revised plan will be an ecosystem based tidal marsh recovery plan with multi-species benefits. Implementation of this plan is envisioned to facilitate recovery of SMHM, CCR, and the endangered soft bird's beak and Suisun thistle populations. This will be accomplished through the conservation, restoration, and enhancement of historic tidal marsh functions and values. The plan will, in part, set goals for conversion of diked managed wetlands to tidal marsh within Suisun Marsh.

5.0 MANDATORY FINDING OF SIGNIFICANCE

5.1 Proposed Action

As the analysis and discussions in Chapter 3 indicate, the Proposed Action alternative would not have the potential to substantially or significantly degrade the quality of the environment. The Environmental Checklist found in Appendix B supports this finding. The proposed actions would be authorized by Corps of Engineers, section 404 under a Nationwide Permit 24 for Restoration Activities a section 401 water quality certification will be issued by the RWQCB. Impacts to biological resources are considered to be less than significant. No new structures would be constructed. It would not eliminate important remnants of California history. Additionally, it would not contribute to significant cumulative environmental effects.

5.1.1 Mitigation Measures for any Significant Effects

As described in 5.1, there would be no significant effects on environmental resources or existing features of the human environment. To avoid potential impacts to SMHM during construction of the levee breaches, avoidance and mitigation measures have been included in the project description for implementation of this project. These measures are included as part of Proposed Action alternative to reduce the effects to a less than significant level.

5.2 No Action Alternative

Under the No Action Alternative, the proposed project would not be implemented and the levee breaches would not be constructed. Consequently, there would be no effects on the environment. No cumulative effects would be incurred from the No Action Alternative.

5.2.1 Mitigation Measures for Any Significant Effects

As discussed in section 5.2, the No Action alternative would cause no significant adverse effects on any environmental resource or existing features of the human environment. Consequently, there are no mitigation measures proposed or required under the No Action Alternative.

6.0 CONSULTATION AND COORDINATION

This draft EA/IS was prepared in consultation and coordination with applicable CEQA and NEPA requirements. The following agencies, organizations, and persons were consulted or involved in the EA/IS process:

Agency or Organization	Name
DFG	Carl Wilcox
USACE	Dave Wickens
SFRWQCB	Jolanta Uchman
USFWS	Janice Engle
NMFS	David Woodbury
NMFS	Gary Stern

Pursuant to 40 CFR 1502.19, this draft EA/IS will be circulated to Federal, State, and local agencies and members of the public who have jurisdiction by law with respect to potential effects of any alternative, and members of the public who have been involved in this proposed action.

7.0 LIST OF PREPARERS

Pursuant to 40 CFR 1502.17, the names and qualifications of the people who were primarily responsible for preparing this EA/IS are presented here.

	CONTRIBUTOR	QUALIFICATIONS	YEARS OF EXPERIENCE
Terri Gaines Staff Environmental Scientist, DWR	Project Description Effects Analysis Cumulative Effects CEQA Compliance	BA Social Ecology/Environmental Planning Graduate studies in Watershed Management	18
John Robles Environmental Specialist, USBR	Purpose and Need NEPA Compliance	BS Conservation Biology BA Resource and Environmental Geography	18
Cassandra Enos Staff Environmental Scientist, DWR	Effects Analysis	BS, Biological Conservation MS, Water Science	15
Patty Quickert Environmental Scientist, DWR	Effects Analysis	BS Wildlife Biology	16

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APPENDIX A

Draft Restoration Plan
for the
Blacklock Restoration Project

PROPOSED BLACKLOCK RESTORATION PROJECT

Suisun Marsh, Solano County, California
SRCD Ownership #635

Prepared By
Division of Environmental Services
California Department of Water Resources

in cooperation with
U.S Bureau of Reclamation
California Department of Fish and Game
U.S. Fish and Wildlife Service
Suisun Resource Conservation District

Revised June 2006

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BLACKLOCK RESTORATION PROJECT
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List of Acronyms

ADCP	Acoustic Doppler current profiler
BCDC	San Francisco Bay Conservation and Development Commission
BLL	Blacklock water quality monitoring station
BMPs	Best management practices
CBDA	California Bay Delta Authority
CCR	California clapper rail
CDEC	California Data Exchange Center
DEM:	Digital elevation model
DFG	California Department of Fish and Game
DWR	Department of Water Resources
EC	Electrical conductivity
ECAT	Environmental Coordination and Advisory Team
FWS	U.S. Fish and Wildlife Service
HDPE	High density polyethylene
MHHW	Mean higher high water
MLLW	Mean lower low water
MSL	Mean sea level
NAVD 88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
NOS/COOPS	National Oceanographic and Atmospheric Administration's Ocean Service/Center for Operational Oceanographic Products and Services
OBS	Optical backscatter
PRBO	Point Reyes Bird Observatory
RWQCB	Regional Water Quality Control Board
SCMAD	Solano County Mosquito Abatement District
SET	Sediment erosion table
SMHM	Salt marsh harvest mouse
SMPA	Suisun Marsh Preservation Agreement
SRCD	Suisun Resource Conservation District
SSC	Suspended sediment concentration
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geographical Survey

BLACKLOCK RESTORATION PROJECT
DRAFT RESTORATION PLAN

1.0 INTRODUCTION

The Department of Water Resources (DWR), in cooperation with the California Department of Fish and Game (DFG), U.S. Bureau of Reclamation (USBR), U.S. Fish and Wildlife Service (FWS), and the Suisun Resource Conservation District (SRCD), has prepared this Restoration Plan for the Blacklock site (Figure 1). This plan describes actions to restore 70 acres of diked, managed marsh to tidal wetlands, using a minimally engineered approach. The project goals and objectives are to 1) restore the area to a fully functioning, self-sustaining marsh ecosystem created through restoration of natural hydrologic, sedimentation and biological processes; 2) increase the area and contiguity of emergent wetlands providing habitat for tidal marsh species; and 3) assist in the recovery of at-risk species.

1.1 Background

DWR received CALFED Ecosystem Restoration Program grant funds in 2001 and acquired this property in December 2003. NEPA/CEQA compliance for the acquisition of this property was completed when DWR filed a Notice of Exemption in May 2003 and the USBR published a FONSI Federal Register in November 2003.

This property is identified as SRCD ownership number 635. The grant proposal, *Suisun Marsh Property Acquisition and Habitat Restoration Project*, was prepared and submitted by DWR in 2000 with collaboration from the Suisun Marsh Preservation Agreement (SMPA) Environmental Coordination and Advisory Team (ECAT), which includes DWR, USBR, DFG, SRCD, and USFWS. Since Suisun Marsh Mitigation Agreement Funding was identified as the source of cost-share funding for this effort, this became an ECAT project.

The original proposal identified that Phase I (acquisition and pre project monitoring) and Phase II (restoration plan development) would be completed with the available funds. Although it was anticipated that additional funding would be required to complete Phase III (environmental documentation and permitting), Phase IV (Implementation of the plan) and Phase V (monitoring). It appears that existing funding will be available to fund the project through implementation. Once this Blacklock Restoration Plan is approved, DWR and the SMPA ECAT agencies will seek additional funding for Phase V.

The plan is organized into the following sections:

Section 1: Introduction and Background

Section 2: Site Description

Section 3: Existing Site Conditions

Section 4: Description of Proposed Project and Alternatives

Section 5: Monitoring

Section 6: Final Design and Implementation Activities

Section 7: References

1.2 Goals and Objectives

The goals and objectives guiding this project are as follows:

Goals: To increase the area of tidal brackish emergent wetlands in Suisun Marsh to aid in the recovery of listed and sensitive species, and (2) acquire scientific knowledge that leads to improved understanding of tidal marsh restoration processes, strategies, and ecological outcomes within Suisun Marsh.

Restoration objectives: To restore the Blacklock property to a self-sustaining functioning brackish tidal marsh by restoring tidal action, reversing subsidence, and promoting establishment of native vegetation and a tidal marsh channel network appropriate to this location within the San Francisco Estuary.

Science objectives: To allow for and encourage collaborative science opportunities in the project design and monitoring phases that supports regional adaptive resource management needs.

1.3 Anticipated Outcomes

Projected outcome scenarios are based on a variety of sources, use of computer models, and review of the literature and evaluation of other restorations within the San Francisco Estuary.

- The site would increase in elevation over time via natural sedimentation processes-mineral sediments moving in from Little Honker Bay and decomposition of vegetation on site.
- Full, unimpeded tidal exchange throughout the site.
- As elevations increase, vegetation will colonize throughout the site.

This restoration represents an opportunity to realize many of the ecosystem benefits that are commonly associated with healthy tidal marsh habitat. Fisheries benefits include providing habitat for delta smelt (*Hypomesus transpacificus*), longfin smelt (*Spirinchus thaleichthys*) Sacramento splittail (*Pogonichthys macrolepidotus*), chinook salmon *(Oncorhynchus tshawytscha)* and other aquatic species. Targeted wildlife species include Suisun song sparrow (*Melospiza melodia maxillaris*), marsh wren (*Cistothorus palustris*), black rail (*Laterallus jamaicensis*), common yellowthroat (*Geothlypis trichas*) and other avian species.

Restoration of tidal flows will produce substantial changes to the habitats and biological, physical, and chemical functions of the site. Immediately after breaching, the site is expected to be shallow open water with remnant emergent vegetation (Figure 2) during much of the tidal cycle and exposed pond bottom and remnant vegetation during low tides.

A new tidal channel network is expected to form, partially re-occupying remnant channels and otherwise forming within the newly forming tidal marsh surface. Vegetation will transition to a mix of species suited to

the intertidal brackish environment, with the site eventually becoming fully vegetated except for channels. Some open water areas may persist in the long term.

Knowledge expected to be gained from this restoration includes but is not limited to rates of sedimentation and marsh development, the role of existing emergent vegetation in influencing sedimentation, channel network formation and overall geomorphology, hydrology, water quality impacts, methyl mercury production, and species use. Results will inform scientists and decision makers in long-term land use and restoration planning throughout Suisun Marsh.

1.4 Organizational Structure

Because of the collaborative structure of ECAT, there are several agencies involved in this planning effort. The Project Work Team (Appendix A) is comprised of those participating in a hands-on effort on this project. While DWR is doing the majority of the data collection and project management, other agencies, institutions and individuals are represented on this team. The Advisory Team (Appendix B) is comprised of staffs from each ECAT agency and others who are providing technical expertise and agency review on the project. The role of the Advisory Team is to review materials developed by the Project Work Team and make recommendations to the SMPA Coordinators, identified as the decision makers. The SMPA Coordinators are an established group comprised of managers from each SMPA agency (DWR, DFG, USBR, SRCD). Staff at DWR, Division of Environmental Services is responsible for Project Management for the Blacklock Restoration Project.

Comments from reviewers during the grant selection and approval process suggested that the team needed to include independent, qualified individuals with expertise in tidal marsh restoration in the region. DWR contracted with Leonard Sklar, Professor of GeoSciences at San Francisco State University to collect sediment transport data in support of restoration plan development. Point Reyes Bird Observatory (PRBO) Conservation Science conducted avian monitoring of the site. Stuart Siegel, Principal of Wetlands and Water Resources was identified as the Science Advisor on this project. In an advisory role, Dr. Siegel has assisted in project development, review of sediment transport data, hydrologic conditions, geomorphology and other data collected in support of restoration plan development.

1.5 Regulatory Jurisdiction

The San Francisco Bay Conservation and Development Commission (BCDC) has jurisdiction over the area as part of the Suisun Marsh Preservation Act. Because this parcel (with the exception of some of the levees) is jurisdictional wetland, the U.S. Army Corps of Engineers (USACE) authorizes work activities under the Section 404 of the Clean Water Act. The Regional Water Quality Control Board (RWQCB) certifies the water quality components under Section 401 of the Clean water Act.

All routine maintenance is authorized under the regional maintenance permit issued by the USACE to the SRCD and DFG.

DWR is the CEQA lead and USBR is the NEPA lead on this project.

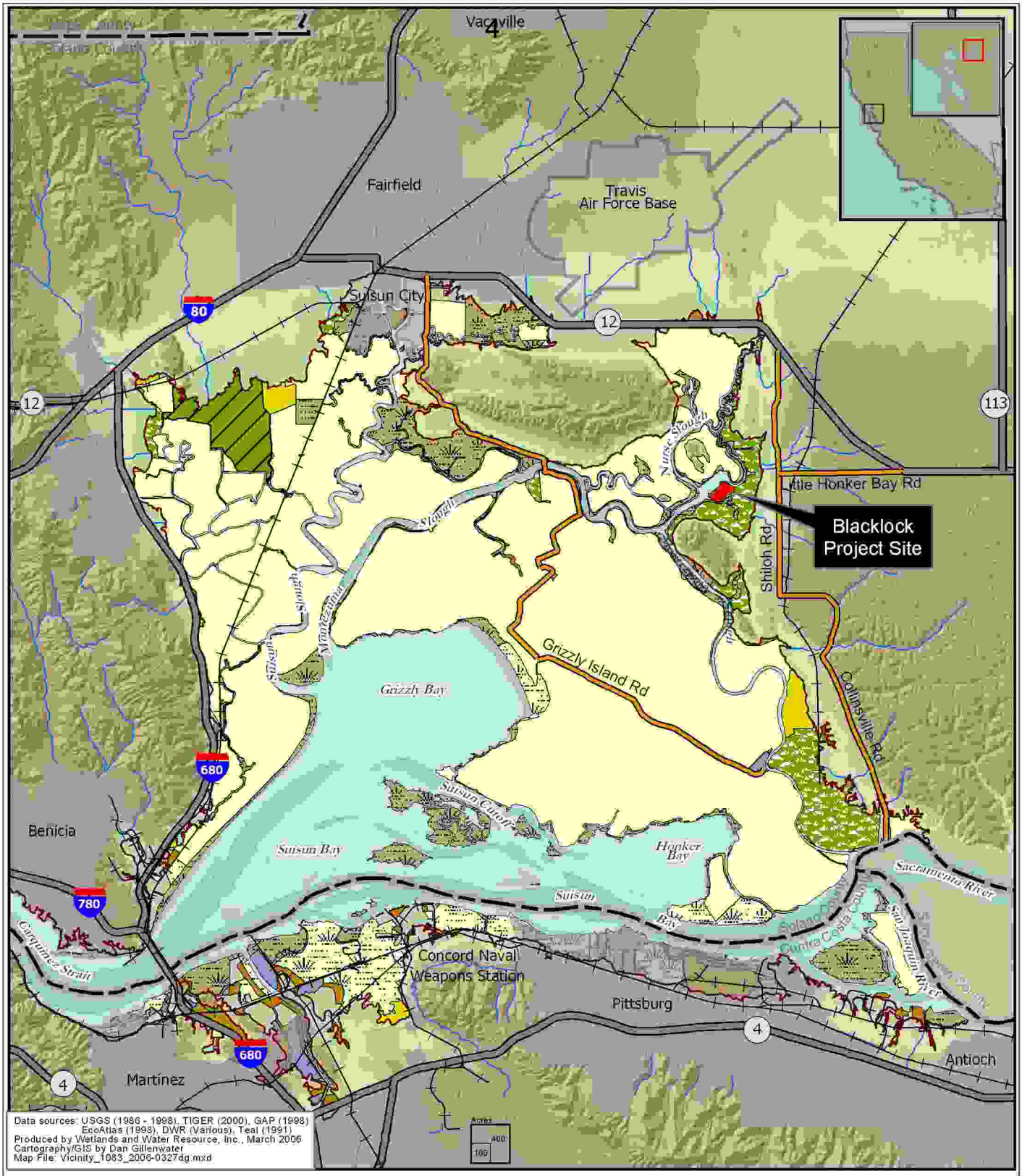


FIGURE 1: BLACKLOCK VICINITY

Blacklock Restoration Project
Solano County, California

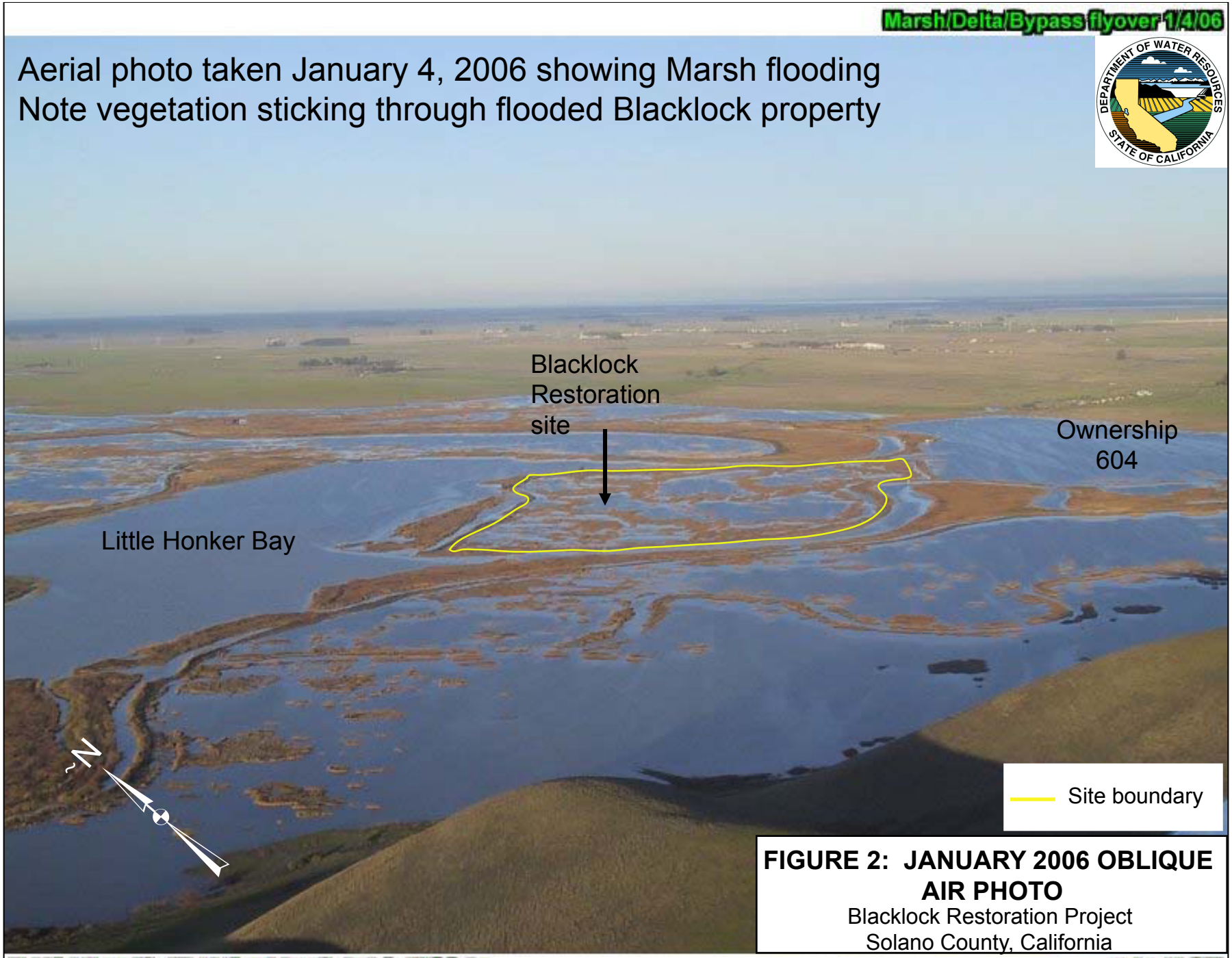


FIGURE 2: JANUARY 2006 OBLIQUE AIR PHOTO

Blacklock Restoration Project
Solano County, California

2.0 SITE DESCRIPTION AND HISTORY

2.1 Location and Physical Features

The Blacklock site is located in the northeast Suisun Marsh bordering Little Honker Bay (Figure 1). The parcel is approximately 70 acres, which includes about 67 acres seasonal wetland and 3 acres upland/levee. Existing site features include a diked, managed marsh, a partial remnant network of sloughs, an interior borrow ditch, and seasonally and perennially ponded areas (Figure 3). There is fringing tidal marsh on the outboard side of the exterior levees.

2.2 Adjacent Properties

The proposed restoration site is bordered by one adjacent property located to the east and separated by a 1,100-foot long levee, which serves as the property line. Three bodies of water identified as Little Honker Bay, Denverton Slough/Little Honker Slough, and Arnold Slough border the remainder of the site to the west, north, and south, respectively. The one adjacent property, marsh ownership 604, is owned by William L. Blacklock and is used for duck hunting and livestock grazing activities.

The adjacent property contains a diked marsh, primarily vegetated with pickleweed (*Salicornia virginica*), grading to a large expanse of upland grassland. The two properties are separated by a levee that was elevated in 2004 to minimize the possibility of overtopping of waters onto the adjacent property.

2.3 Site History and Land Use

The Blacklock restoration site has been owned and operated by the Blacklock family since 1936, and has been used for livestock grazing and duck hunting activities since 1946 (DWR 2003). The past owner used the entire Blacklock Ranch property primarily for grazing, with some waterfowl hunting in the southwest portion of the Blacklock Ranch including the 70 acres acquired by DWR. Management on the wetland area was minimal, consisting primarily of flooding and circulation during duck hunting season.

The SRCD has developed 11 water management schedule guidelines to assist wetland property owners and managers. The goal of these water management schedules is to optimize the waterfowl forage and cover value. Selection of the appropriate water management schedule is based on location in the Marsh, water control facilities, and water type. Location of a club will determine whether or not its management is affected by endangered species closures. Clubs affected by endangered species closures must restrict or close water intake structures during specific periods to prevent adverse impacts to Chinook salmon and/or delta smelt.

Past club management on the site was variable and did not strictly adhere to any of SRCD's water management schedules. According to Mr. Blacklock, initial flooding of the ponds started in early to mid-October. Ponds were flooded to a maximum depth of 12". Water levels remained static through mid-December at which time the water level was lowered slightly to make invertebrates more easily accessible to feeding waterfowl. Intakes were closed from February 21st through March 31st due to salmon closure requirements. The pond was drained by mid- to late-June and allowed to dry out for cattle grazing. Based on the existing topography and interviews with the owner, disking, ditching and burning on the property were minimal.

Levee maintenance appears to have been minimal and inadequate to protect the property from occasional tidal overtopping. The levees were maintained primarily by borrowing material from the interior toe ditch. It appears that rip-rap was periodically imported to maintain a portion of the exterior levee along little Honker Bay.

2.4 Interim Management

DWR, with cooperation from SRCD, developed an Interim Management Plan for the property in January 2004. This plan, which identifies several potential management goals proposed for the site, was reviewed and approved by the SMPA Coordinators. An underlying premise of the strategies described in the plan is that during the interim management period, land use at the site will continue to be a seasonal wetland and each of these management goals must be achieved utilizing existing strategies for seasonal wetland management. This plan is available on-line at http://iep.water.ca.gov/suisun/restoration/blacklock/doc/Blacklock.

Upon careful review of the plan, the Advisory Team recommended, and the SMPA Coordinators supported, the interim management strategy to prepare the site for restoration. This management strategy described how to maintain managed wetland in a manner that will not conflict with, and will work towards, the long-term goals of tidal marsh restoration. This management strategy would be achieved by implementing actions that increase vegetation cover at the site prior to breaching. As described in the plan, actions could also incorporate studies evaluating methods for subsidence reversal and, where necessary, substrate modification.

As described in the plan, interim management would include moderate water control manipulation, moderate vegetation control and an investigation of techniques for subsidence control and substrate modification. The plan identified advantages of this strategy to include: 1) consistency with the long-term goal of tidal marsh recovery, and 2) creation of physical conditions conducive to tidal marsh evolution. This strategy was also seen as a way to inform the larger California Bay Delta Authority (CBDA) goals for tidal wetland restoration in Suisun Marsh.

In implementing this strategy, DWR has been manipulating water on the site through the existing 36-inch culvert to encourage the growth of emergent vegetation and allow for circulation throughout the property. In late summer of both 2004 and 2005, the pond was drained (to the extent possible) to allow for construction work on the cross levee (described in section 3.3.1). Once levee construction was completed, the property was re-flooded to previous levels.

FIGURE 3: 2004 AERIAL PHOTO

Blacklock Restoration Project
Solano County, California

3.0 EXISTING SITE CONDITIONS

3.1 Physical Features

3.1.1 Topography

The Department of Water Resources conducted a field elevation survey of the site in August 2002. Figure 4 shows the digital elevation model (DEM) created by DWR and updated by WWR using the topographic data. Elevations at the site range from approximately -1.9 feet up to 9.2 feet (NAVD 88). With the exception of the levees and the two well sites, most of the property is subsided, with elevations less than about 3 feet and less than about 1 foot on most of the site. The mean sea level at this location is approximately 4 feet. Additional elevation surveys were conducted on the perimeter borrow ditch and slough network during 2005.

3.1.2 Soils

The U.S. Department of Agriculture soil survey for Solano County (USDA 1975) shows only two soil types at the Site. The area inside the levee is Tamba Mucky Clay, and Tidal Marsh soils are present outside the levees.

The Tamba soil series consists of very poorly drained, fine-textured soils with a high organic matter component. The soils occupy nearly level salt and brackish water marshes and are formed in mixed alluvium from mixed sources and hydrophytic plant remains. In a typical profile, the mucky clay extends to a depth of more than five feet.

This very poorly drained soil is moderately permeable. The surface runoff is ponded and the erosion hazard is slight to none. The total available water holding capacity is 3-5 inches. The effective rooting depth is shallow and the soil has low fertility. Areas with this type of soil association are typically used for wildlife habitat, recreation (irrigated duck ponds) and grazing.

The tidal marsh soil is a very wet, poorly drained, and strongly saline soil type that has unobstructed access to tidal water. This land ranges from unvegetated mud flats that are inundated daily by tidal flow to a mixture of hydrophytic plant remains and alluvium that is covered by water only at high tide and are (at this site) thickly vegetated with *Schoenoplectus Bolboschoenus* and *Typha*. Permeability and runoff rates are low with these soils. Effective rooting depth is very shallow and fertility is very low. This land type is used for wildlife habitat and recreational uses. (US Department of Agriculture, 1975)

3.1.3 Hydrology

Because of the location and relative isolation of the parcel, there are no watershed inflows that would affect the hydrology of the site except under extreme tidal/flooding scenarios as occurred in 1998, 2005 and 2006. Tidal inundation, as described below, along with site elevation, has the greatest influence on the development of a fully functioning tidal marsh.

The Blacklock parcel has been flooded since late December 2005. Weather and Delta outflows during winter 2006 resulted in higher than normal tides throughout Suisun Marsh, sometimes 1-2 feet above predicted levels. The flooding is due to overtopping of the levees at high tides and seepage through the levee in several locations.

As a managed wetland, the hydrology of the site is primarily controlled by one 36-inch water control structure located along Arnold Slough (Figure 5); however, uncontrolled intermittent levee overtopping such that occurred during winter 2006 also impacts water levels.

Water Control

There is one water control structure for both flooding and draining the property. The structure consists of a 36-inch corrugated metal pipe with a screw-flap gate on the slough side and a winch flap gate on the interior side. The gate was installed in the summer of 1998 and is in good working order. There is also a 48-inch pipe under the road to the well pad to allow circulation in the borrow ditch that runs along the interior toe of the levees. This culvert under the road was replaced with high density polyethylene (HDPE) pipe in August 2005. A flashboard riser was installed on the west side of the pipe, and will be closed upon breaching of the levee to reduce circulation in the perimeter borrow ditch.

Tidal Datum Reckoning

DWR contracted with the National Oceanographic and Atmospheric Administration's Ocean Service / Center for Operational Oceanographic Products and Services (NOS/CO-OPS) to install a water level observation gauge on Bradmoor Island in 2004 where it had previously operated a station in the 1970's (Station ID NOS 941-4811). The purpose of the gauge is to determine the tidal datum (heights and range of the tides) for the Nurse Slough/Denverton Slough complex in the northeast Marsh, in the vicinity of the Blacklock property. The project included installation of two geodetic benchmarks to augment three existing benchmarks.

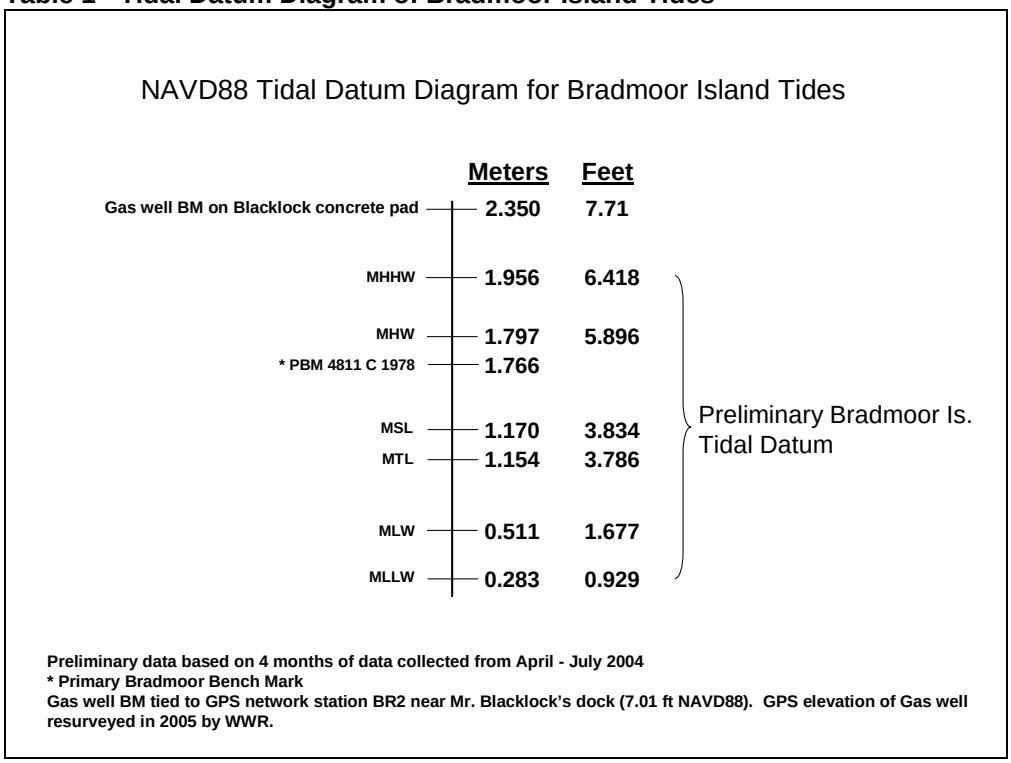
NOS/COOPS will use these data to update tidal datum and tide predictions for this station. NOS/COOPS agreed to install and operate the tide gauge for a minimum of one-year and to use recently developed tidal datum calculation standards (NOAA 2003) to update the tidal datum at the Bradmoor station site. Five benchmarks are required to meet survey standards; three historical benchmarks currently exist at the site. Elevations of all five benchmarks were checked during water level instrument installation (April 2004), and after 6-months. NOAA removed the gauge in April 2006.

NOS/COOPS processed the data and computed a preliminary 4-month (April through July, 2004) tidal datum (Table 1). Several height statistics are represented including mean higher high water (MHHW), mean sea level (MSL), and mean lower low water (MLLW). All heights are referenced to the North American Vertical Datum of 1988 (NAVD 88). NOS/COOPS will provide a final report on the tidal datum elevations and the geodetic datum relationships to DWR when available. All preliminary and verified data obtained from the Bradmoor station is available on a real-time basis via the NOS website at http://tidesonline.nos.noaa.gov/.

A water quality monitoring station was installed at the northeast corner of the Blacklock property (Figure 5). This station monitors tide stage, electrical conductivity (EC) and temperature in Denverton /Little Honker Slough. The station also monitors precipitation, wind speed and direction. In addition, a pressure transducer was installed in the borrow ditch of the Blacklock property to monitor interior water levels. After breaching, this sensor will provide data on the extent of tidal inundation. This station is identified as BLL on the California Data Exchange Center (CDEC) network. Hourly data is available on-line at http://cdec2.water.ca.gov/cgi-progs/queryFx?s=bll.

When the full-year report is available, DWR will produce an analysis of the difference between Bradmoor and Blacklock tidal datums. Preliminarily, the stage signal between Bradmoor and Blacklock is very similar as shown on Table 1. Stage at the Blacklock gage is tending to be a few centimeters higher than Bradmoor at high tide.

Table 1 - Tidal Datum Diagram of Bradmoor Island Tides



Existing Slough Network

There are remnants of the historic tidal marsh slough network on the site (see Figure 3). DWR surveyed slough topography as part of its August 2002 survey. To supplement the original survey, additional surveys of the slough bottoms were conducted in March 2005. These remnant sloughs range in width from 5 to 15 feet and in depth from ½ to 2 feet across the site. In addition, there is a perimeter borrow ditch around the property along the interior toe of the exterior levee. Over the years, material has been removed from this ditch and used to maintain the levees. An elevation survey of this ditch was conducted in 2005. The width of the borrow ditch varies from approximately 10 feet to 35 feet wide and extends into ponded areas at several locations throughout the parcel.

3.1.4 Suspended Sediment Concentration

Methods

In-situ suspended sediment sampling was carried out at two locations outside the Blacklock site at Little Honker Bay and Arnold's Slough (Figure 5). Little Honker Bay, west of the Department of Water Resources Blacklock property, is a small open water body. Arnold Slough, south of the Blacklock property is a narrow slough channel. At each location, a D&A Instruments OBS-3 sensor connected to an OWL2c data logger was mounted 0.9 feet above the substrate. Approximately every two weeks the OBS sensor was cleaned, data from the datalogger downloaded, and batteries exchanged. The sensor at Arnold Slough was deployed from December 21, 2004 to January 4, 2006. The Little Honker Bay sensor was deployed December 21, 2006 and is presently still collecting data.

OBS readings were taken once every 12 minutes (or 15 minutes for a few deployments) to correspond with the NOS tidal gauge at the nearby Bradmoor Island station. Each sample burst consisted of 64 samples at 0.1Hz. The data logger recorded date, time, battery voltage, and OBS minimum, maximum, average, and standard deviation.

The OBS sensors were calibrated in the field using four different concentrations of field sediment/water samples. The actual sediment concentration of the calibration samples was analyzed in the laboratory using the ASTM standard D 3977 – 97, "Standard Test Methods for Determining Sediment Concentration in Water Samples". "Method B-Filtration" was used for all samples collected.

Data was filtered for a number of factors that were thought to cause unsound data. First, errant data due to the logger taking readings when the sensor was out of the water for maintenance at the start and end of each deployment were filtered. Second, records portraying a low battery status (less than 9.7v) were filtered out. Third, data was filtered out each time the water surface was within 1.0 feet of the sensor head (as determined by the NOS Bradmoor Island tidal records) as the OBS sensor reports errant readings from ambient light. Lastly, to remove data flyers, a difference from the running mean (one hour before and after) was calculated and any data with greater than a 20 percent difference was filtered out.

Due to the combination of sediment and algae collecting on the optical surfaces of the OBS sensors, data drift was apparent and corrected for using fitted curves based on the difference in readings pre- and post-cleaning.

Results

Suspended sediment concentration (SSC, milligrams per liter or mg/L) results are shown in Figure 6. Results are shown separately for Little Honker Bay and Arnold Slough, and the difference in magnitude of the 2-hour running mean between the two stations is also shown in order to illustrate differences between the two locations.

At Little Honker Bay, concentrations ranged from a low of about 20 mg/L to nearly 500 mg/L, with most values being less than 200 mg/L. Data shows a small spring-neap tide cycle signal. SSC tended to be higher in the winter and spring months and lowest in the fall months. At Arnold Slough, concentrations ranged from a low of about 30 mg/L to a high of about 430 mg/L, with most values being less than 150 mg/L. Arnold Slough shows the same seasonal pattern observed at Little Honker Bay.

The SSC difference between the two stations shows greater SSC values at Little Honker Bayduring winter, spring and summer months, with the difference ranging from 10-30 mg/L commonly and in some instances up to 200 mg/L. Values were higher at Arnold Slough during the fall, by about 10-20 mg/L typically.

These results provide two beneficial pieces of information. First, they indicate that a reasonable sediment supply exists to support natural sedimentation within the Blacklock site. The values observed are within commonly seen ranges elsewhere in the San Francisco Estuary where natural sedimentation is known to occur in tidal marsh restoration sites (PWA and Faber 2004). Second, these data can support sediment transport modeling that DWR may undertake after project construction to develop more insight into physical processes promoting tidal marsh restoration in Suisun.

3.2 Existing Biological Conditions

3.2.1 Regional Biology

The regional biology of the Suisun Marsh is described in general in the Bayland Habitat Goals Report (1999) and the final report prepared in 2001 by the Suisun Ecological Workgroup at the request of the State Water Resources Control Board. This report can be found on line at http://www.iep.ca.gov/suisun_eco_workgroup/final_report/SEWFinalReport.pdf. Most of the Suisun Marsh is diked seasonal wetlands managed for waterfowl habitat. A few tidal marshes remain along Suisun and Cutoff Sloughs (Rush Ranch), Hill Slough, and Peytonia Slough. Marsh ponds exist to a limited extent in low areas of diked baylands.

3.2.2 Ecosystem Types

The site is characterized by 3 main ecosystem types: upland, seasonal wetland, and aquatic. The upland areas of the site are restricted to the levees and the abandoned well pad. The sloughs and pond areas comprise the aquatic areas of the site; over the past several years, water has remained in the central portion of the site year-round. The majority of the site is managed seasonal wetland. The distribution of vegetation present is primarily a function of the topography on the site and inundation due to water management.

3.2.3 Special Status Species

A list of sensitive species of wildlife and plants that are known to occur in the vicinity of the Blacklock Restoration site is provided in Appendix C. No special status species of plants have been observed within the project boundaries but several including Masons liliaopsis (*Liliaeopsis masonii*), Suisun Marsh aster (*Aster lentus*), Suisun thistle (*Cirsium hydrophilum var hydrophilum*), Delta tule pea (*Lathyrus jepsonii var jepsonii*), soft bird's-beak (*Cordylanthus mollis mollis*) and Contra Costa goldfields (*Lasthenia conjuguens*) are found in the Suisun Marsh.

With the exception of the State and federally listed salt marsh harvest mouse (*Reithrodontomys raviventris halicoetes*), and Suisun song sparrow (*Melospiza melodia maxillareies*), no sensitive wildlife species have been observed within the project area. The results of SMHM surveys are described below in section 3.2.7. Bird surveys are described in Section 3.2.6 below. Surveys for California black rail (*Laterallus jamaicensis coturniculus*) are ongoing.

3.2.4 Vegetation

The Department of Fish and Game, Wildlife Habitat Division conducted a comprehensive vegetation survey of Suisun Marsh in 1999. Change detection surveys were conducted in 2000 and 2003. Figure 7 shows the Blacklock portion of the resulting vegetation map representing conditions in June 2003. Vegetation in the wetland consists primarily of tules (*Shoenoplectus acutus*), cattails (*Typha*) and saltgrass (*Distichlis spicata*), with some waterfowl food plants such as brass buttons (*Cotula coronopifolia*) and alkali bulrush *(Bolboschoenus maritimus)*. Vegetation along the levee includes native rose (*Rosa californica*), blackberry (*Rubus discolor*), and annual grasses. With the site inundated since January 2006, only emergent vegetation is visible; salt grass and pickleweed is submerged.

3.2.5 Aquatic Species

Three locations (Figure 8) were beach seined on August 25, 2004 to evaluate pre-project fish presence and diversity. At the sites seined, water depth varied from 0.3 to 3.0 feet. Seining was done days before the culvert was re-opened following the end of the Chinook salmon closure period. Three locations were chosen for sampling according to a likelihood of catch and for their accessibility. A beach seine was used to span the channel and corral fishes present to the bank where individuals were placed into a holding bucket for identification.

Native and introduced species were captured at all three locations. Native fishes caught include tule perch (*Hysterocarpus traskii traskii),* prickly sculpin (*Cottus asper*), three-spine stickleback (*Gasterosteus aculeatus)* and Sacramento blackfish (*Orthodon microlepidotus*). Black crappie (*Pomoxis negromaculatus)*, Shimofuri gobi (*Tridentiger bifasciatus*), inland silversides (*Menida beryllina*), mosquito fish (*Gambusia affinis*), brown bullhead (*Ictalurus nebulosus*), carp (*Cyprinus carpio*) and American shad (*Alosa sapidissima*)comprise the introduced species sampled. Temperature, D.O. and E.C. were recorded prior to seining for each site. Numerous *Palaeomon* shrimp, crayfish and other invertebrates were also observed. Table 2 shows the results of the 2004 survey.

Table 2 - Fisheries sampling results

Native Species		**Sampling locations as shown on Figure 8**
Tule perch	*Hysterocarpus traski*	3
Prickly sculpin	*Cottus asper*	1,2
Three-spine stickleback	*Gasterosteus aculeatus*	1
Sacramento blackfish	*Orthodon microlepidotus*	3
Introduced Species		
Black crappie	*Pomoxis nigromaculatus*	1,2,3
Shimofuri gobi	*Tridentiger bifasciatus*	1,2
Inland silverside	*Menidia beryllina*	2,3
Mosquito fish	*Gambusia affinis*	1,2,3
Brown bullhead or Black bullhead	*Ameiurus nebulosus Ameiurus melas*	3
Carp	*Cyprinus carpio*	2
American shad		3
Invertebrates		
shrimp	*Palaeomon*	1,3
Crayfish		3
Others		1,2,3

From DWR fisheries sampling August 25, 2004
1) borrow ditch on SE side of property, and NE side of well road culvert near diversion intake structure
2) first-order slough from borrow ditch (south of well pad) to 20 feet interior;
3) borrow ditch at NE corner of site from corner to 25 feet to the SW.

3.2.6 Birds

PRBO Conservation Science (PRBO) biologists conducted a variety of surveys at the Blacklock restoration site, periodically through the annual cycle, from spring 2004 to spring 2005. In addition, PRBO conducted avian surveys at additional sites in the vicinity of the Blacklock site. Surveys were conducted at two nearby sites: a managed, seasonal marsh located on the Delta King Ranch and a fringing tidal marsh on the Overlook property neighboring Blacklock ranch (Figure 8). The Overlook site was intended to serve in part as a "reference" site, indicative of the future tidal marsh habitat to be developed as a result of the Blacklock restoration project. A fourth site, Rush Ranch, was surveyed in spring 2004 and spring 2005; this site was chosen as a good example of the target tidal marsh habitat in a site that is more comparable in size and configuration to the Blacklock site and therefore can serve as a good reference site.

Objectives of the project addressed by this study include:

- What are the impacts to avian species of converting seasonal, managed wetlands to tidal marsh? Which species can be expected to be more prevalent and which species less prevalent as a result of this habitat change?
- How does the pattern of habitat use (e.g., seasonally) by birds change as a result of habitat change?
- What are the characteristics of restored tidal marsh habitat and the surrounding landscape, as applied to Suisun Marsh, that maximize its wildlife value to birds?

To address these questions, variable-distance point count surveys were conducted once a season (fall, winter) or twice a season (early spring, late spring; no surveys during summer) at each site. This type of survey provides an index of abundance for each species and information on species composition, covering all avian species and is the survey method best suited for passerines and other "landbirds." A second type of survey, area surveys (also termed "line-transect surveys") was carried out at the less vegetated Delta King and Blacklock sites. This type of survey provides an index of bird abundance and provides information on non-passerines such as waterfowl, shorebirds, and herons and egrets (though these groups are also surveyed by point counts). The behavior and micro-habitat utilization of the birds was also recorded with area surveys.

Survey locations at Blacklock are shown on Figure 8. California Black Rails (*Laterallus jamaicensis coturniculus*) were surveyed in the spring of 2005 at the three Blacklock-vicinity sites; these species-specific surveys are conducted twice during the breeding season. This state-threatened subspecies is highly secretive but very vocal, especially when taped calls are played back. A fourth survey, specifically for California clapper rails (CCR) (*Rallus longirostris obsoletus*) was conducted in the area surrounding Rush Ranch. CCR surveys were not not conducted in the vicinity of Blacklock because the property in not in within the critical habitat of this species. Marshwide surveys for CCR do not extend this far east. Protocols for all surveys used were consistent with those developed as part of the San Francisco Estuary Wetlands Regional Monitoring Program (San Francisco Estuary Wetlands Regional Monitoring Program 2002; www.wrmp.org).

Species richness was moderately high at the Blacklock site with 27 different species present at the site including Suisun song sparrow (*Melospiza melodia maxillaris*), marsh wren (*Cistothorus palustris*), and common yellowthroat (*Geothlypis trichas*). These three species or subspecies are mainly dependent on tidal-marsh habitat, though they may also use habitat with limited tidal flow, provided the appropriate vegetation is present. During the breeding season, bird use at the Blacklock site was limited: only 12 species were detected. In contrast, the Overlook site displayed higher species richness throughout the year (33 species detected) and specifically during the breeding season (16 species detected). The Rush Ranch site, where surveys were conducted during the breeding season only, demonstrated 15 species.

One difference between the Blacklock pre-restoration site and the two tidal marsh sites (Overlook and Rush Ranch) is the higher abundance of common yellowthroats and Black Rails at the tidal marsh sites, especially at Rush Ranch. For example, Black Rail Surveys at Rush Ranch in 2001 (the last year conducted there) revealed detections of this species at 6 out of 10 survey stations. At the Blacklock site, there were detections at only 2 of the 10 survey stations. Similarly, common yellowthroats displayed high abundance at Rush Ranch, almost equal to that of marsh wrens, whereas this was not the case at the Blacklock site. Studies conducted in San Pablo Bay and Suisun Bay by PRBO biologists demonstrated that common yellowthroats are present at marshes of all ages but that their abundance increases with marsh age, thus, on average, ancient tidal marshes displayed the highest density and young restoration sites the lowest density (Nur et al. 2004)

In addition, the study demonstrated the value of managed marsh as bird habitat. The Delta King site demonstrated a species richness of 48 species over the course of 1 year and 29 species detected during the

breeding season, values that are about twice that observed at the Blacklock site and also substantially greater than at the tidal marsh sites. Dabbling ducks are one species group that benefits from managed marsh habitat, and to an extent, piscivorous birds do as well (such as gulls, terns, herons, and egrets).

Many tidal marsh-dependent species are year-round residents. For them, the chief value of tidal marsh habitat is as breeding habitat. Such species include song sparrows, common yellowthroats, marsh wrens, and black rails. There are a few waterbird species that also utilize tidal marsh habitat for breeding, for example, snowy egrets (*Egretta thula*) which were detected at Overlook site during the breeding season. However, for most waterbirds species, the chief value of tidal marsh habitat, and also managed marsh habitat, is for foraging and roosting during the migratory periods (fall and spring) and during the winter. Studies conducted at young restoration sites demonstrated the value of these sites for waterbirds during the fall and winter periods (Nur et al. 2004, Nur et al. 2005); this is especially so for shorebirds.

The results of this study, coupled with that of other studies conducted in San Francisco Estuary (Nur et al. 2004, Nur et al. 2005), suggest that a wide spectrum of birds will benefit from planned restoration projects. The value to birds will be greatest when the target sites are currently not managed or with a low level of management, as at Blacklock Ranch. Shorebirds will especially benefit from young restored marshes where channels and mudflats are present and vegetation of the marsh plain is not complete. However, dabbling ducks will be able to use young and mature marsh provided that foraging opportunities (e.g., channels) are present. Passerines, such as song sparrows and common yellowthroats, will benefit from tidal marsh habitat, though they are able to utilize pre-restoration habitat as well. Black rails, however, appear to be more dependent on mature tidal marsh.

At the same time, there is clearly great benefit to birds provided by intensively managed shallow-water habitat. Thus, restoration plans that call for a mosaic of habitat types, and thus a high heterogeneity of habitat types will be most beneficial to a wide range of bird species. Within a habitat, structural (including vegetational) heterogeneity should also be promoted. Tall vegetation favors some species (e.g., common yellowthroats) while dense, short vegetation favors others (e.g., black rails; Spautz et al. in press). Many species benefit from a developed system of channels and the vegetation (e.g., *Grindelia*) that is found along those channels.

3.2.7 Salt marsh harvest mouse

The salt marsh harvest mouse (SMHM, *Reithrodontomys raviventris*) is a federal and State endangered species endemic to the brackish and salt water marshes around the San Francisco Bay Estuary. There are two subspecies, and it is the northern subspecies, (*R.r. haliocetes*), that is found in the Suisun Marsh. DWR conducted SMHM surveys in 2003, 2004 and 2005. Each survey was done using Sherman live traps, which were opened for four consecutive nights.

In 2003 two areas of the pond were surveyed: Grid Pond 1 in the NE pond where vegetation is primarily salt grass (*Distichlis spicata*) and fat hen (*Atriplex triangularis*), and grids 2 and 2a in the SE pond near the well pad, which is primarily pickleweed (*Salicornia virginica*). A total of 105 traps were set, and SMHM were captured only in the area around the well pad.

In 2004, surveys were conducted in the two areas surveyed in 2003 (grids Pond 1, 2 and 2a) and five additional areas, including three areas along the exterior levee (Pond 3, 4, 4a and Levee 1, 2 and 3). A total of 108 traps were set for four consecutive nights. Vegetation at the levee sites was primarily *Schoenoplectus* and *Typha*, and except for the area near the well pad (Grids 2 and 2a), which was primarily pickleweed, the pond sites were primarily salt grass.

In 2005, six areas were surveyed: grids Pond 1, 2, 3, 5 and Levee 1 and 2. The only new area was Pond 5, located in the southwest corner of the pond in an area vegetated with tall emergents such as Typha and *Schoenoplectus*. Survey results are in Table 3 and the survey sites shown on Figure 8.

Because the pond was flooded during the winter of 2005/2006 and has remained flooded with 1-2 feet of water since then, all SMHM habitat within the pond is inundated.

Table 3 - SMHM Survey results by grid at Blacklock, 2003-2005

Grid	2003		2004		2005	
	# traps	Results[1]	# traps	Results	# traps	Results
Pond 1	30	1 WHM	20	3 UNHM, 2 WHM	15	1 WHM
Pond 2	53	7 SMHM	15	2 UNHM, 2 WHM	18	
Pond 2a	22	5 SMHM	7	1 WHM	N/A	
Pond 3	N/A		15	2 SMHM, 3 UNHM, 2 WHM	11	1 SMHM
Pond 4	N/A		8		N/A	
Pond 4a	N/A		10		N/A	
Pond 5	N/A		N/A		16	1 SMHM, 1 UNHM, 3 WHM
Levee 1	N/A		14	2 SMHM, 2 WHM	20	2 UNHM, 3 WHM
Levee 2	N/A		10	3 SMHM, 2 UNHM, 2 WHM	20	1 SMHM, 4 UNHM, 5 WHM
Levee 3	N/A		9	1 WHM	N/A	

1/ SMHM=salt marsh harvest mouse; UNHM=unknown harvest mouse, morphological characters between those of SMHM and WHM; WHM=western harvest mouse, *Reithrodontomys megalotis*.

3.3 Historical and Cultural Resources

A search of the records maintained at the Northwest Information Center of the California Historical Resources Information System at Sonoma State University did not identify any previously recorded cultural resources in the project area or vicinity, nor have any cultural resources studies previously been conducted in the project area. Contact with the Native American Heritage Commission and local Native American representatives failed to identify the presence of any traditional cultural properties or sacred sites within the proposed project acreage.

3.4 Constraints

3.4.1 Adjacent Subsided Lands

The property includes approximately 1.5 miles of levees consisting of 1.3 miles of exterior levees and approximately 0.2 miles of an interior "cross" levee. The exterior levees are along Little Honker Bay or

adjacent sloughs. DWR surveys conducted during summer 2004 indicate the elevations of the exterior levees range between 6.4 and 9.2 feet NAVD, with an error of 0.5 foot. Overtopping of the levee occurs in several locations during high tides. Figure 9 shows the locations where the levee is less than 7 feet NAVD and susceptible to overtopping in high tides. The width of the levee crown is variable, ranging from 6 to 10 feet.

Significant damage occurred in several locations during the December 2004 - January 2005 high tides, and again during the January 2006 storm event. A California Conservation Crew placed visquine and sandbags in three of the more severely eroded locations during January 2005 to prevent further erosion to these sites (Figure 10). During 2003 and 2004, DWR maintenance crews made repairs to the erosion area at Stn 47+00 (Figure 10). Continued overtopping at this site, and others has resulted in erosion of the pondside levee slope and crown of the levee. It is no longer possible to safely drive a vehicle around the exterior levee as the crown roadway is reduced to less than 6 feet in some areas.

DWR environmental and engineering staff evaluated the severely eroded levee sections and have determined that it is likely that the levee will breach in one or more of these locations unless significant and costly repairs are made. Funding is unavailable to complete major repairs on the levee in these sections. In May 2005, the Advisory Team recommended, and the SMPA Coordinators agreed, to forgo additional costly repairs to the severely eroded levee sections and instead, develop the restoration plan acknowledging the physical constraints of the property.

On December 12, 2005, DWR staff discovered water flowing through a hole in the levee near Stn 52+00. The hole, near the top of the levee on the Little Honker Bay side of the levee, was approximately 18 inches long and 10 inches wide. There was a "sinkhole" about 6 feet from the crown on the pond side of the levee, approximately 4 feet wide, 6 feet long and 5 feet deep. Material had eroded back towards the crown of the levee from the pond side. Because the hole on the Little Honker Bay side is near the crown of the levee, water only flows at tides over 5 feet. DWR engineering staff predicts that subsequent high tides will continue to enlarge the hole and erode the levee material, eventually leading to a levee breach in this location.

Another hole was discovered in the levee during January 2006. This hole, located near Stn. 14+00 was approximately 5 feet long and 2 feet wide on the levee crown. Levee material had eroded away under the crown from the hole (approximately 2/3 of the way across the levee) towards Arnold Slough. Material remained in place along north 1/3 of the levee (pond side). This hole was thought to be caused by beaver activity in the area. This hole was repaired in April 2006.

Cross-Levee

There is a short interior levee (~1,100 feet) between the Blacklock property and the adjacent Blacklock Ranch. Because the poor condition of the exterior levees on the property poses a risk for levee failure and unplanned breaching, this cross levee was raised to elevation 9 feet during September and October 2004. The nine foot elevation will protect the adjacent property from flooding in the event of an unplanned levee failure, and minimize DWR's flood liability, when the property is opened to the tides. All levee work was authorized under the USACE regional general permit 24215N issued to SRCD and DFG. The RGP sets limits on the quantity of material each property is allowed to place; thus DWR was unable to import sufficient material to construct the levee with the desired slope during 2004. Additional material was placed on the (west) slope during the 2005 construction season to restore a 2:1 side slope to the levee. Imported material was used to raise the levee. The material was tested for contaminants prior to placement.

In October 2004, DWR staff revegetated the DWR side of the levee with native grass seed, covered in straw and a jute mat to promote growth of native grasses, reduce weed growth and prevent erosion. This treatment was successful in protecting the levee during the winter of 2004-2005 when the property was inundated as a result of levee overtopping during the high tides. However, this revegetation effort was covered with additional material during the 2005 levee work. During January 2006, the levee slope and toe was revegetated

with *Schoenoplectus californicus (*previously called *Scirpus californicus)*. This species will remain viable during the winter months. It is anticipated that this species will colonize up the levee slope with inundation of the parcel when tidal action is introduced to the site.

To protect the levee slope from wind and wave erosion, brush boxes were installed on the cross levee slope in early 2006 as an alternative to rip rap for levee slope protection. Brush boxes are constructed by driving 2 parallel rows of 3-inch diameter wooden poles along the levee slope. Recycled Christmas trees were placed between the poles and secured in place. This method has been used successfully in other areas of Suisun Marsh and in the Sacramento-San Joaquin Delta.

Under existing conditions, the adjacent Blacklock Ranch floods via overtopping of its levees under extremely high tides. This condition occurred during the January 2006 storm event. This flooding is unrelated to the Blacklock Restoration Project. Therefore, while maintaining the cross levee to maintain existing levels of flood protection is a high priority for this project, the purpose is to maintain existing levels of flood protection provided by the restoration site, and not to protect adjacent lands from any flooding.

3.4.2 Abandoned Gas Wells

The property contains two abandoned gas wells. Blacklock Number One was drilled in 1951 and abandoned in 1954. Blacklock Number Two was drilled in 1954 and abandoned in 1972. Both wells were capped and decommissioned according to accepted industry and government standards in 1954 and 1972 respectively (DWR 2003). The wells are classified as being "plugged and abandoned – dry hole" by Weatherford Artificial Lift Systems, Inc., the previous well owner. Weatherford relinquished all rights to Mr. Blacklock in January 2003, and ownership of the wells passed to DWR with purchase of the parcel. No additional work is required on the wells (DWR 2005). The well pad for Blacklock Number One was dismantled and removed from the site; while the well pad for Blacklock Number Two is still intact (Figure 5). Remnants of the roads leading to the well pad still exist on the site.

3.4.3 Vector Control

Since acquiring the property, DWR has worked cooperatively with the Solano County Mosquito Abatement District (SCMAD) to control mosquitos. SCMAD annually samples properties in Suisun Marsh for mosquito production. Prior to DWR acquiring the parcel, SCMAD had records of only two treatments at the site: October 1998 and October 2000. Solano County Mosquito Abatement District inspected the site in October 2004 and found a problem with mosquito production, primarily in the areas dominated by salt grass. SCMAD aerially sprayed the parcel in October 2004 and subsequently billed DWR for vector control. No treatment was necessary in 2005.

The Solano County Mosquito Abatement District (SCMAD) has developed policies for management of tidal marsh restoration. After tidal inundation, DWR will continue to work cooperatively with SCMAD to minimize mosquito production at the site.

3.4.4 Non-native vegetation

While much of the vegetation on site is native, desirable marsh species, several acres of *Phragmites australis* are present in the ponds. This species is a rapidly spreading weed that out competes native emergent vegetation. It is a problem throughout Suisun Marsh, and marshwide eradication/control programs have been initiated. An invasive species monitoring and control program is discussed in section 5.2.6.

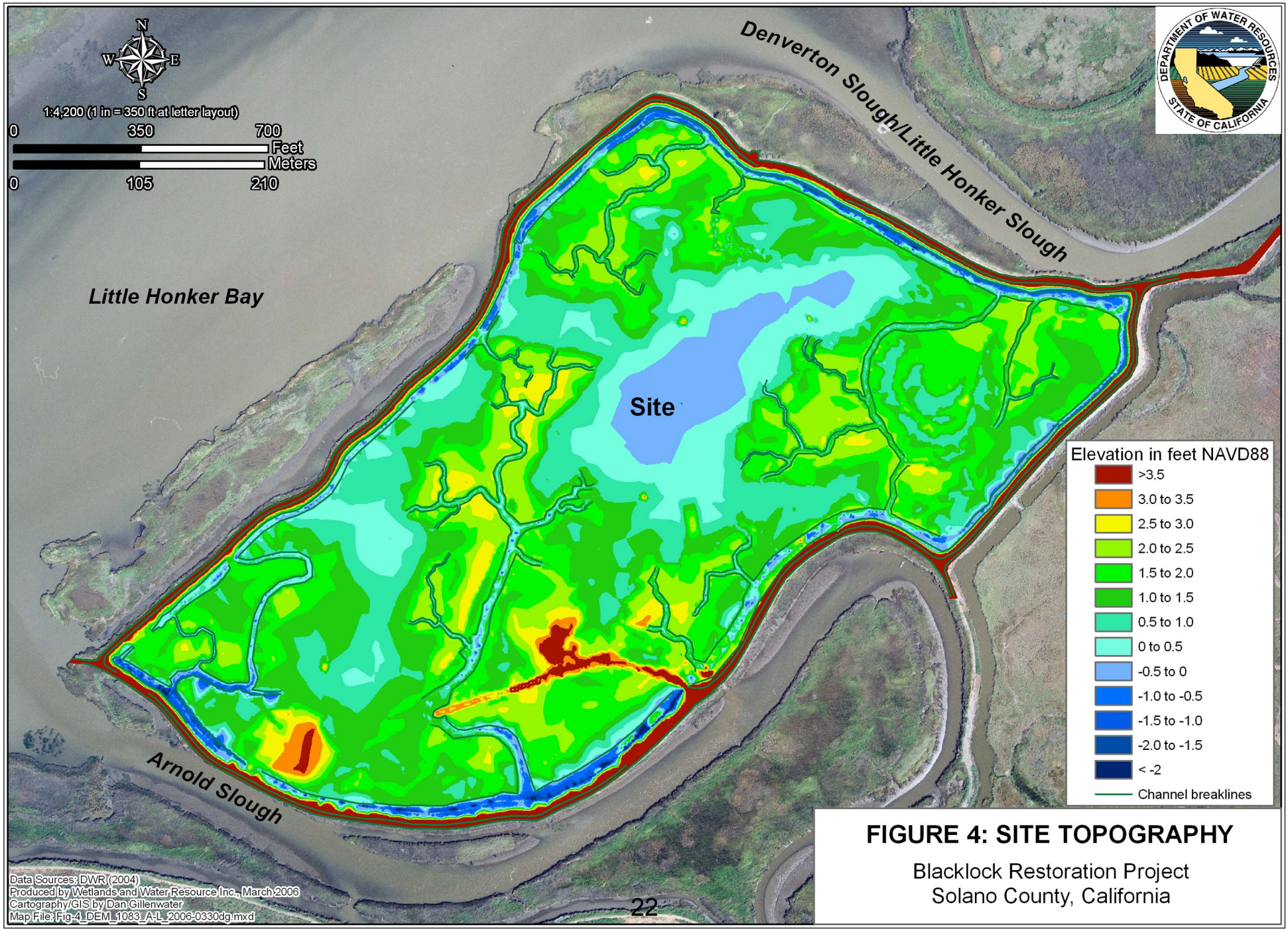


FIGURE 4: SITE TOPOGRAPHY

Blacklock Restoration Project
Solano County, California

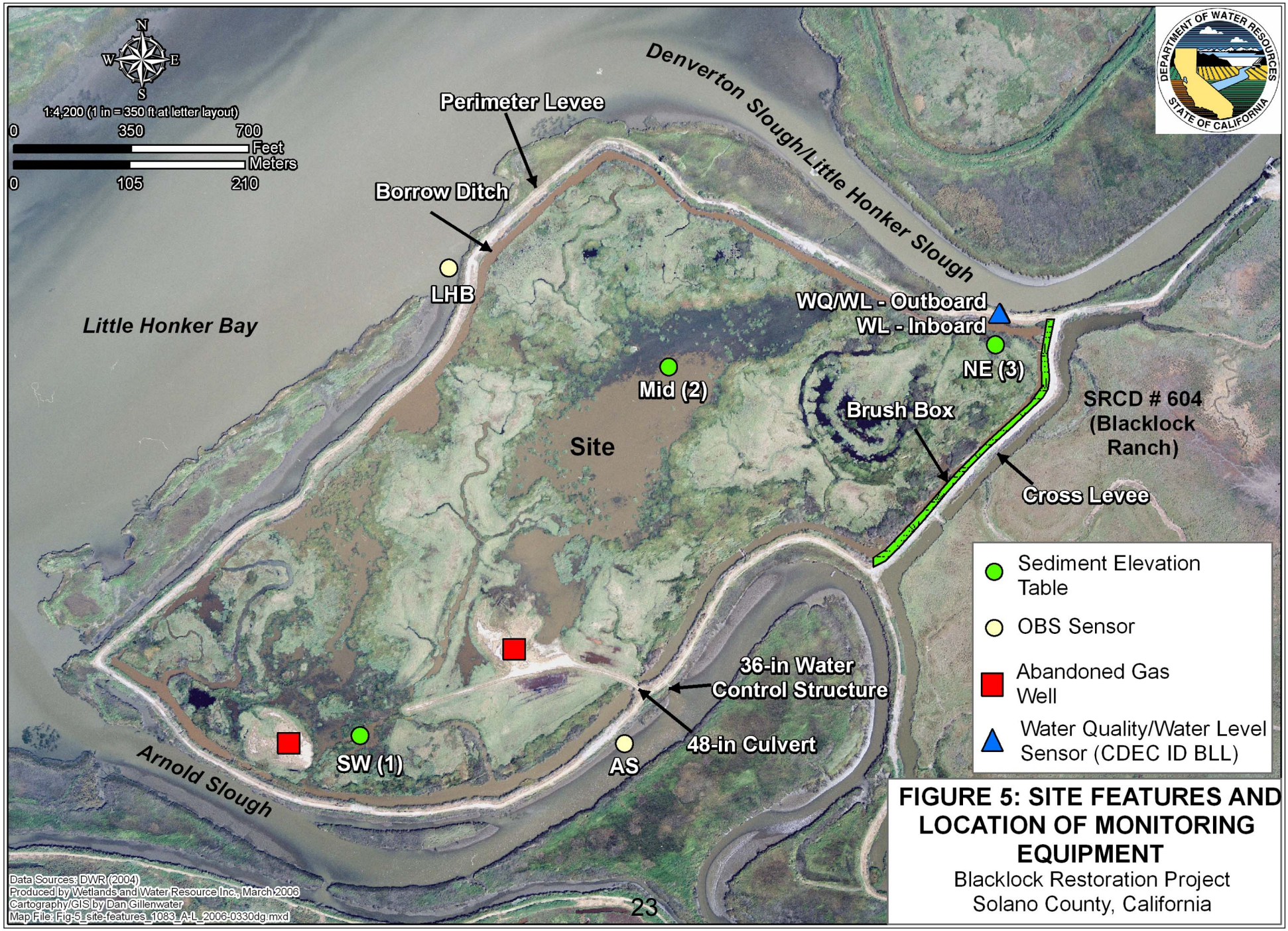
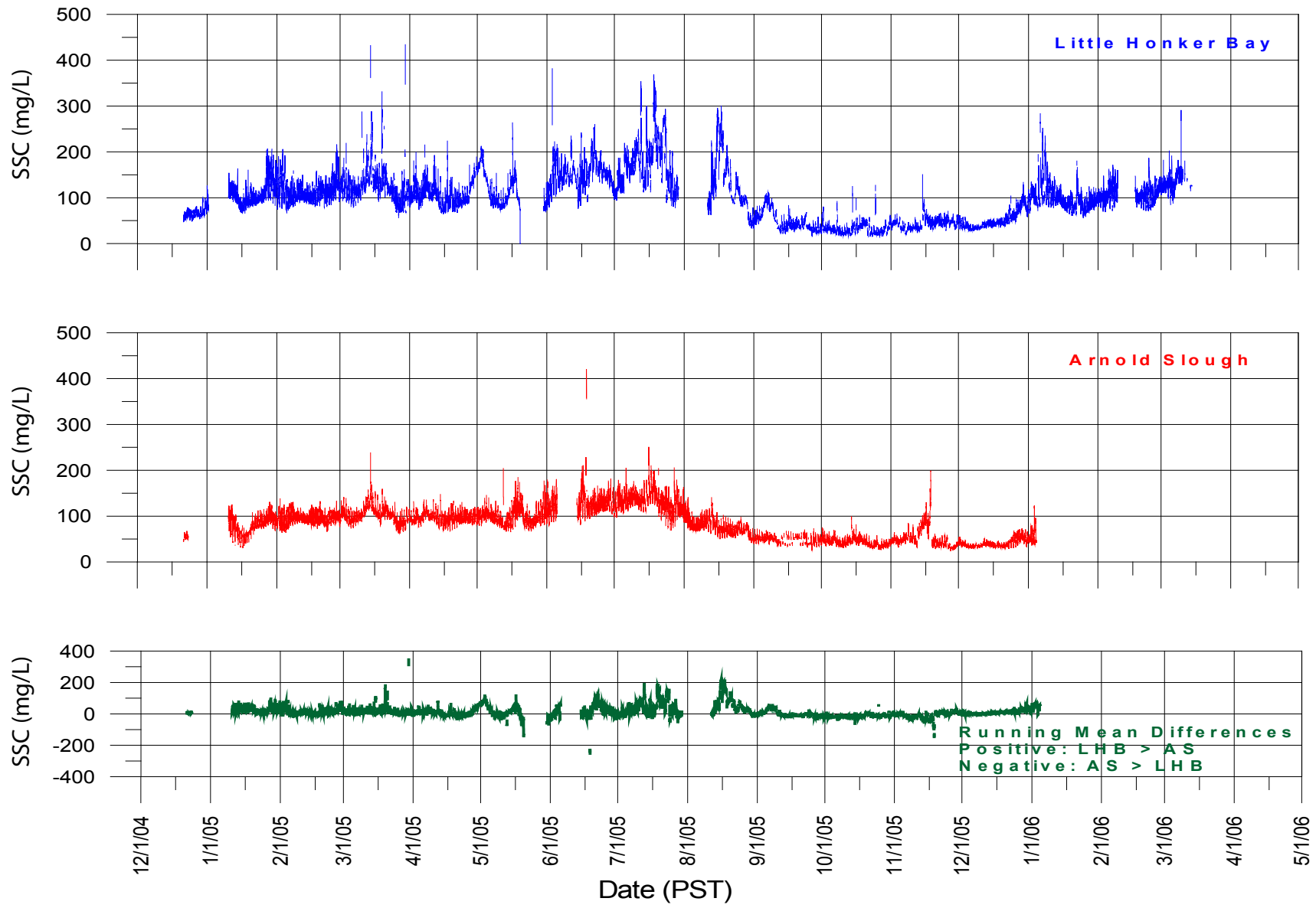


FIGURE 5: SITE FEATURES AND LOCATION OF MONITORING EQUIPMENT

Blacklock Restoration Project
Solano County, California



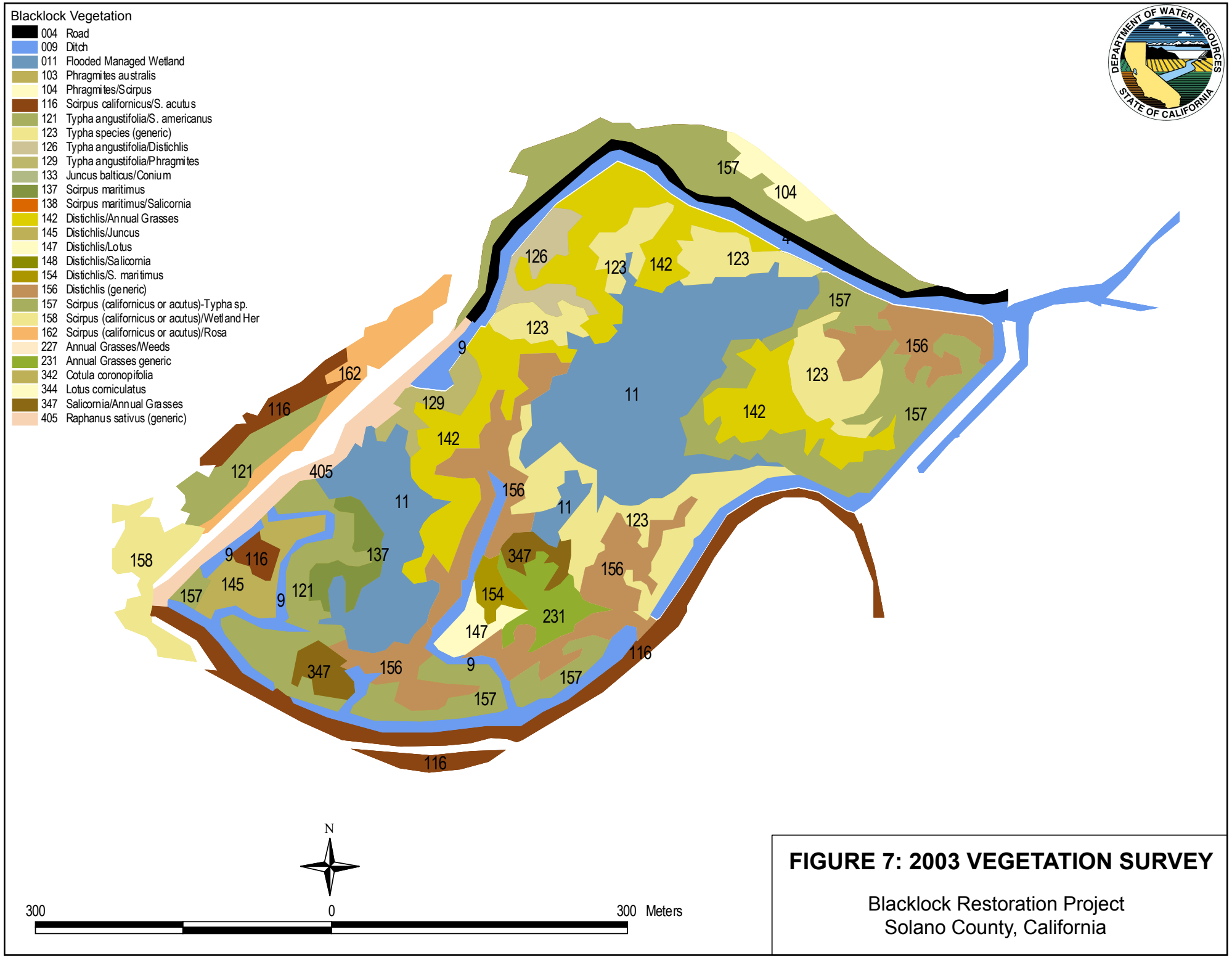
	Arnold Slough	Little Honker Bay
Maximum	420	499
75th Percentile	104	126
Mean	82	98
Median	85	96
25th Percentile	51	57
Minimum	4	14

DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

FIGURE 6: SUSPENDED SEDIMENT CONCENTRATIONS AND COMPARISONS

Blacklock Restoration Project
Solano County, California

\\Server3\wwr_network\Active_Projects\1083_Blacklock\113-RestPlan\RP Figures Mar 2006\Fig-6_OBS_SSC Plot 2006-00403sra


Blacklock Vegetation
004 Road
009 Ditch
011 Flooded Managed Wetland
103 Phragmites australis
104 Phragmites/Scirpus
116 Scirpus californicus/S. acutus
121 Typha angustifolia/S. americanus
123 Typha species (generic)
126 Typha angustifolia/Distichlis
129 Typha angustifolia/Phragmites
133 Juncus balticus/Conium
137 Scirpus maritimus
138 Scirpus maritimus/Salicornia
142 Distichlis/Annual Grasses
145 Distichlis/Juncus
147 Distichlis/Lotus
148 Distichlis/Salicornia
154 Distichlis/S. maritimus
156 Distichlis (generic)
157 Scirpus (californicus or acutus)-Typha sp.
158 Scirpus (californicus or acutus)/Wetland Her
162 Scirpus (californicus or acutus)/Rosa
227 Annual Grasses/Weeds
231 Annual Grasses generic
342 Cotula coronopifolia
344 Lotus corniculatus
347 Salicornia/Annual Grasses
405 Raphanus sativus (generic)
DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA
N
300 0 300 Meters
FIGURE 7: 2003 VEGETATION SURVEY
Blacklock Restoration Project
Solano County, California

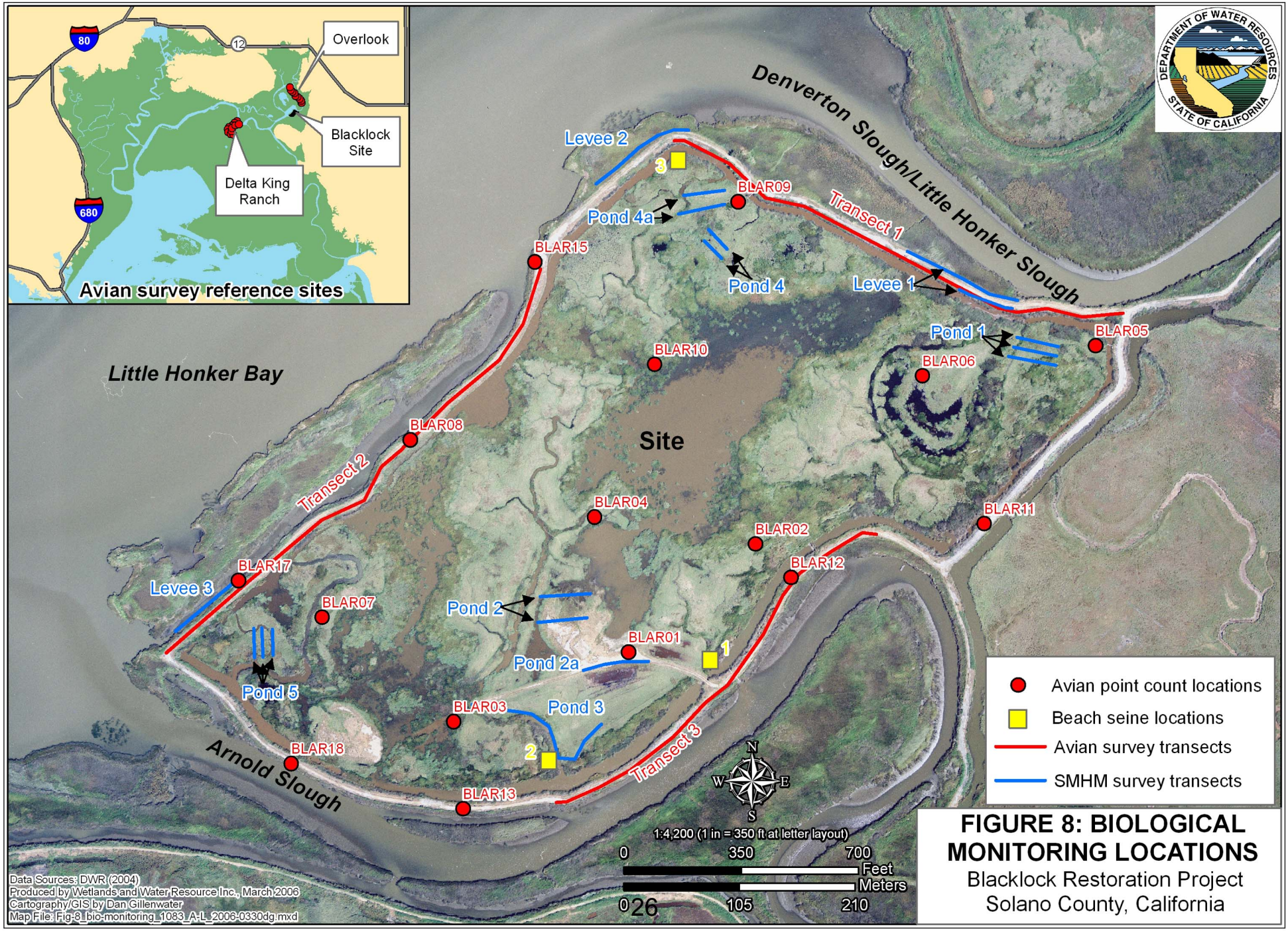


FIGURE 8: BIOLOGICAL MONITORING LOCATIONS

Blacklock Restoration Project
Solano County, California

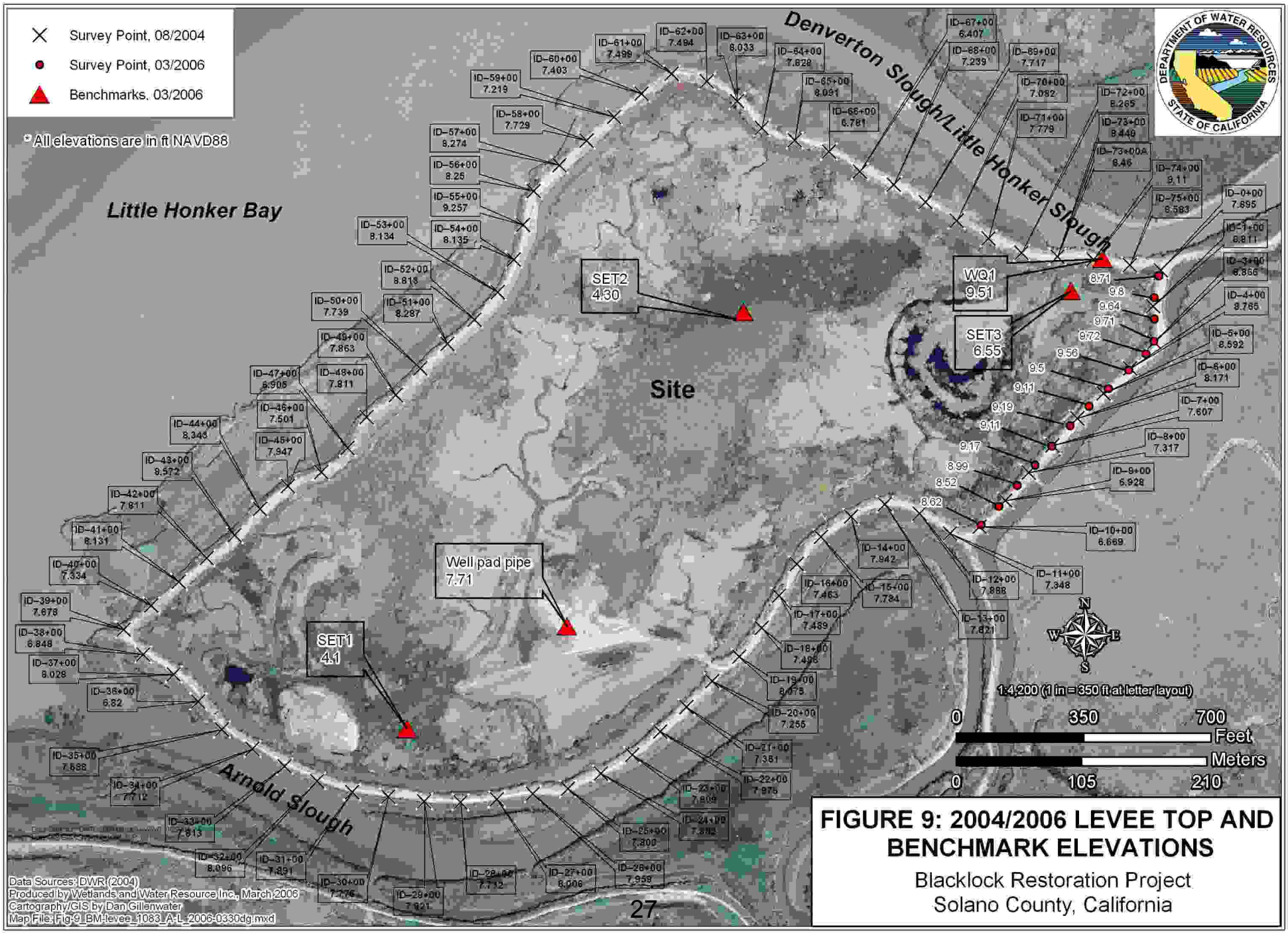


FIGURE 9: 2004/2006 LEVEE TOP AND BENCHMARK ELEVATIONS

Blacklock Restoration Project
Solano County, California

4.0 DESCRIPTION OF PROPOSED PROJECT

This section describes the proposed restoration efforts needed to implement the project. The underlying restoration requirement for this site is subsidence reversal, as the site ranges from 3 to more than 5 feet below local mean high water. The overall approach for the Blacklock Restoration Project calls for a passive strategy in which the exterior levee is breached, natural sedimentation and plant detritus accumulation restores intertidal elevations, and natural colonization establishes the plant and wildlife communities. The project includes a "pre-vegetation" element to promote these natural restoration processes. Tidal flow is expected to utilize the existing remnant channels to some extent, with some new channels forming as sedimentation progresses. This design is a minimal-engineering approach that relies on natural processes to meet project goals and objectives.

Because of the poor condition of the exterior levee, an unintended levee failure may occur prior to implementation of a final plan. Therefore, two alternative approaches are presented to address this uncertainty.

4.1 Proposed Levee Breaches

4.1.1 Identifying Options

To achieve project goals and objectives of restoring the Blacklock property to a self-sustaining functioning brackish tidal marsh, candidate breach locations were evaluated to optimize import and deposition of adjacent channel sentiment to the site. The location of levee breaches has a significant influence on subsidence reversal through sediment accretion and vegetation development.

The effectiveness of a levee breach for importing sediment depends on several factors including orientation to prevailing wind, channel depth adjacent to the levee breach, topography of the area behind levee breach, remnant channel location, and vegetation composition.

- Orientation to prevailing wind. In general, the breaches oriented to receive prevailing wind fetch are more likely to receive suspended sediment on flood tides, especially during fair wind afternoon periods.
- Adjacent channel sediment availability. The availability of suspended sediment in adjacent channels is partly a function of channel depth. Breaches near shallow channels or shoals may import higher suspended sediment concentrations.
- Site topography behind levee breach. An important element of promoting suspended sediment influx into a restored site is the ability to transport sediment throughout the site. Breaches should be located adjacent to low points within the site interior so as to facilitate tidal transport of suspended sediment throughout the site.
- Remnant tidal sloughs. To the extent possible breaches should be located to take advantage of remnant tidal creek channels to conduct tidal energy further into the site and to re-establish those channels as natural channels to the extent possible.
- Vegetation composition. Similar to the topography immediately behind levee breach, vegetation composition will also control tidal energy penetration. Tidal energy will enter the restoration site as a "jet" with significant shear flow to either side of the maximum velocity zone. It is desirable to locate levee breaches such that the high velocity zone is relatively unobstructed by vegetation.

4.1.2 Hydrodynamic Modeling to Evaluate Options

DWR staff utilized hydrodynamic modeling as a planning and predictive tool to investigate alternative breach options for the Blacklock Restoration Project. RMA2, a depth-averaged two-dimensional hydrodynamic model (King, 1997), was used to simulate the water levels on the Blacklock property and its vicinity. Using a turbulence sub-model to represent the local effect of velocity gradients, RMA2 applies the finite element method to solve the equations of mass and momentum conservation, thus describing the depth-averaged two-dimensional unsteady hydrodynamics within the water body. The model has the capability to simulate irregular boundaries, dry and wet node conditions and sub-surface flows on tidal wetlands.

The RMA model is based on the equations of mass and momentum conservation (Navier-stokes equations). Since these equations are deterministic, error margin is not of a concern (unlike statistical formulations). Navier-stokes equations are able to describe a flow field very accurately given boundary conditions. In contrast, there are several sources of uncertainty that are likely greater than any error in the model formulation. These include uncertainty about friction due to variable vegetation, and general uncertainty about the location and nature of natural levee breaches as they made it appear at the site. The model is used to highlight the sensitivity of the flow field inside Blacklock to these very frictional and geometric uncertainties. The Bay Delta RMA2 model was provided by Resource Management Associates Inc.

4.1.2.1 Modeling Scenarios

Several breach scenarios were modeled. Scenarios evaluated effects of varying locations, widths, and numbers of breaches. The first set of scenarios investigated the impact of breach size on Blacklock water levels. Two conditions were considered: the first adds a 10 meter levee breach at station 55+00 (Scenario 1) (Figure 10), the second adds a levee breach at the same location but increases the breach width from 10 meters to 20 meters (Scenario 2). Both scenarios have the breach footing elevation at -0.34 meters NAVD. The second set of scenarios investigated the impact of breach locations. The breach was made at station 47+00 (Scenario 3) and station 55+00 (Scenario 4), respectively. Both scenarios have a breach width of 20 meters and the breach footing elevation at -0.34 NAVD. A third set of scenarios investigated the impact of the number of breaches. Two conditions were assumed for this investigation, one with a breach at station 55+00 (Scenario 5) and the other with three breaches at stations 36+00, 47+00 and 55+00 (Scenario 6). All the breaches have a width of 20 meters and a footing elevation at -0.34 meter NAVD. Finally, the sensitivity of the model, specifically the model's sensitivity to the bed roughness coefficient, was investigated. Three bed roughness coefficients (n = 0.07, 0.15 and 0.25) were considered for the sensitivity study. The levee breach condition was assumed to be the same as Scenario 1. The summary of scenarios is presented in Table 4. Modeling results are summarized below.

4.1.2.2 Modeling Results

The Impact of breach size (Scenarios 1 and 2). Increasing the breach width from 10 meters to 20 meters did not significantly affect Blacklock water levels. Figures 11 and 12 show the water levels at node 4993 (east side of the property, bottom elevation 0.25 meter NAVD) and node 5457 (west side of the property, bottom elevation 0.045 NAVD) for the different levee breach configurations. Very little difference in the water levels can be seen between the two scenarios.

Table 4 - Summary of Modeling Scenarios

Group	Scenario	Breach Location	Breach Configuration	
			Width(m)	Footing Elevation (m NGVD)
Breach Sizes	1	Stn 56+00	10	-1.17
	2	Stn 56+00	20	-1.17
Breach Locations	3	Stn 47+00	20	-1.17
	4	Stn 56+00	20	-1.17
Breach Number	5	Stn 56+00	20	-1.17
	6	Stn 56+00 Stn 47+00 Stn 36+00	20	-1.17

The impact of breach location (Scenarios 3 and 4). Location of the breach significantly affected the low tide water levels. Figures 13 and 14 show water levels at nodes 4993 and 5457 for the breaches made at stations 47+00 and 56+00. Station 47+00 is behind an island and is relatively hidden while station 56+00 has a direct connection to Little Honker Bay. Comparing the simulation results with the two breach locations, it is apparent that during low tides Blacklock water levels are lower if the breach was made at a location with a direct connection to the bay. The difference in the water levels between Scenarios 3 and 4 can be as high as 0.18 meter (7 inches) during a low tide. High tide water levels did not appear to differ significantly. This finding is significant for selecting a suitable breach location when water levels during low tides are of a main concern for certain species in the restoration process.

The impact of the number of breaches (Scenarios 5 and 6). The number of breaches also affected Blacklock water levels. Figures 15 and 16 show the water levels at nodes 4993 and 5457 for one breach and three breach conditions, respectively. Under a multiple (three) breaches condition, it was easier for water to be drained out of the property thus led to lower water levels during low tides. At node 4993, the difference in water level during low tide can be as high as 0.19 meter (7.6 inches) between the one-breach and three-breach conditions. As with scenarios 3 and 4, high tide water levels were not significantly different.

Model Sensitivity. The model is sensitive to bed roughness coefficients (i.e., Manning's n). The higher the Manning's n, the higher the friction head loss, thus the lower the velocities and the higher the water levels. Figures 17 and 18 show the differences in water levels simulated with Manning's n equals 0.07, 0.15 and 0.25 in heavily vegetated areas. At node 5457, the difference in the water levels can be as high as 0.1 meter (3.8 inches) with $n = 0.07$ and $n = 0.25$ respectively.

Other simulation results. For Scenarios 1 through 6, during high tides, the water levels inside of the Blacklock property are the same as those on Little Honker Bay (Figures 19 and 20). However, during low tides, the water levels inside of the Blacklock property are always higher than those on Little Honker Bay. This may

have resulted from the high friction loss caused by heavy vegetation on the property preventing water from draining during low tide.

It was also found that for Scenarios 1 through 6, the flow field on Blacklock is asymmetrical (Figures 21 and 22): it has longer ebb periods and lower velocities while the flood periods are shorter and velocities are higher. This asymmetry in flow field may provide a potential mechanism for sediment to be trapped in the Blacklock property thus facilitate the marsh restoration processes if sediment supplies from the bay are high.

4.1.2.3 Additional Modeling Needs

Because sediment transport is important for tidal wetland restoration, DWR modeling staff recommend that future modeling include a sediment transport model for the Blacklock property and vicinity to study the sediment transportation and deposition.
In addition, DWR modeling staff recommend future modeling include a water quality model for the Blacklock property to evaluate possible water quality issues involved in the restoration process.

The hydrodynamic, sediment and water quality models would need to be calibrated and verified when the stage, flow, sediment and water quality data at the Blacklock property are available.

4.2 Restoration Approaches

4.2.1 Preferred Approach: Constructed Levee Breaches

Modeling results indicate that the site drains better at low tide with two breaches on the property. Therefore, two locations, 55+00 and 25+00 are identified as preferred breach locations for the constructed breach alternative. Station 55+00, along Little Honker Bay (Figure 10) would allow for an unimpeded exchange of flows during tidal cycles. Because there is no in-channel island or fringing tidal marsh here, it is expected that a breach at this location would optimize the transport of available Little Honker Bay sediments into the property to raise surface elevation through sediment deposition. In addition, a breach at this location could take advantage of the remnant tidal slough network within the property. It is unlikely that an unintended levee failure would occur at this location. The levee is wider and higher than other areas and there is riprap on the waterside slope and toe.

The second breach would be located along Arnold Slough, preferably at 25+00, which lines up nicely with an existing channel and would serve the southwest corner well. An alternate location for the second breach is near 35+00, which is close to an existing channel but avoids the outboard marsh (a viable alternative to 25+00). In addition, the levee is highly eroded at the southwest corner of the property. One consideration in determining preferred breach location is that when the tide enters through a breach, it's most likely to continue in a straight line for some reasonable distance before meandering; just south ("right") of the 55+00 breach, once past the borrow ditch, is higher ground, which could have the effect of limiting tidal exchange to the southwest corner. Thus a breach between 20+00 and 53+00 would serve the southwest corner well.

Modeling suggests that a breach size of at least 65 feet (20 meters) would be sufficient for full tidal exchange.

4.2.2 Secondary Approach: Unintended Levee Failure

Much of the exterior levee of this parcel is in poor condition. In addition to the hole near Stn 52+00, several areas along the exterior levee are severely eroded (Figure 10). Erosion is most severe at Stn. 47+50 and from 36+00 to 38+00. Without additional maintenance to the levee near Stn 52+00 and other severely eroded areas, DWR and SRCD staff as well as Dr. Siegel (Science Advisor) expect that a breach at one or more of these locations will occur within the next year, and possibly sooner.

In the event of an unintended levee failure at one of the expected or another location along the exterior levee, the site will be monitored to assess whether project goals, objectives and desired outcomes are being achieved. Specifically, monitoring will focus on the tidal regime inside the parcel, evolution of the breaches, tidal exchange through the breach, marsh development, sediment accretion and elevation changes within the subsided lands. Biological objectives will also be evaluated including what fish species are using the site and vegetation development.

The Advisory Team will use this information to evaluate if the unplanned breach is sufficient for development of a functioning tidal marsh ecosystem. If not, the site will be adaptively managed (as described below) to promote full tidal exchange and tidal marsh development. Options include increasing the size of the natural breach, deepening the natural breach, or creating additional breaches in the exterior levee. The likely location of an additional breach would be at 55+00.

4.3 Construction Methods

Under the proposed constructed alternative, the levee would be breached by excavating the levee during low tide. The levee would be breached during one low tide cycle, and would be scheduled to coincide with the lowest (projected) tide during the available construction window.

All heavy equipment would access the site from the levee. In each location a 65 foot (20 meter) breach will be constructed using a long-reach excavator. Material would be removed to a depth of 1 foot NAVD to allow unimpeded tidal exchange during a tidal cycle. A maximum of 1000 yards of material would be excavated from each breach. Excavated material would be used to raise low areas of the exterior levee, placed as ditch blocks or in ponds as subsidence reversal material. Any material placed on the exterior levee would be graded when dry, if heavy equipment can access the site after the breach. Any material placed in the ponds would be not be compacted, but left as placed.

Access for heavy equipment would be from Shiloh Road, through the Blacklock Ranch (ownership 604), and to the site. DWR acquired an easement through this parcel when the restoration site was acquired in 2003.

Pre-construction environmental documentation would be prepared and included as part of a Nationwide Permit 27 issued by the USACE. All permit conditions and construction best management practices (BMPs) will be followed to minimize impacts to the project area and sensitive habitats. A qualified biologist will be on site at all times during construction.

4.4 Operations and Maintenance

4.4.1 Cross Levee Maintenance

To prevent flooding of the Ownership #604, Blacklock Ranch, the cross-levee was raised to 9.0 feet NAVD during 2004. During 2005, additional material was added to the cross-levee to restore the 2:1 side slope on the proposed restoration side of the levee. The base of the cross-levee was revegetated with *Schoenoplectus californicas* in 2005. Brush boxes were installed on the cross-levee slope in early 2006 to provide wavewash erosion protection. In addition, woody vegetation was planted on the levee slope above the brushboxes. The brushboxes are expected to provide erosion protection for 3-5 years, giving time for the revegetated levee to

mature. This alternative approach to protect the levee slope will be evaluated for effectiveness. If the brushboxes do not provide adequate protection, additional measures will be considered.

The east (non-project) side of the levee sustained moderate damage during the January 2006 storm and high tide event. The adjacent property flooded during the high tides and wind fetch across the open water of the adjacent parcel resulted in erosion to the east side of the cross levee. Once permits and material are obtained, this side of the levee will be repaired and revegetated. Maintaining the cross levee is, and will continue to be, a high priority.

4.4.2 Exterior Levee Maintenance

Maintenance on a portion of the exterior levee from 56+00 to 75+00 will continue to occur until the levee is breached at 55+00. In the event of an unintended levee failure, maintaining the levee from 55+00 to 75+00 is necessary to allow the excavating equipment access to the preferred breach location, unless a decision is made that a breach at the preferred breach location is not necessary. Sections of this levee, specifically around 64+00 through 69+00 are some of the lowest on the property, and frequently overtop at tides over 6.2 feet NAVD. However, since there is a wide fringing marsh in this location, which dissipates the energy of the high tides, this area does not have the heavily eroded waterside slope of other areas. Maintenance of this levee would likely include placing imported material to raise the levee and maintain access for equipment necessary to breach the levee, if needed.

In addition, the exterior levee will also be maintained from 11+00, the end of the cross levee to 25+00 until a determination is made that unimpeded tidal exchange is achieved. Maintaining this section of levee along Arnold Slough will allow access from the cross levee to the water control structure and culvert under the well pad road.

Vegetation control including mowing and weed control will continue along the crown of the exterior levee to allow pedestrian access for as long as is practical. This will allow agency staff and those involved with the restoration access to evaluate levee and site conditions, and conduct monitoring. Access will be limited to foot traffic and ATV's since the levees are unsafe for larger vehicles.

It is expected that the remaining exterior levees will erode over time, resulting in additional breaches.

4.4.3 Vector Control

SCMAD BMP's will be followed to control mosquito production on restored wetlands at Blacklock. DWR will continue to work with the SCMAD to minimize mosquito production. The site will be treated as necessary at the recommendation of SCMAD.

4.4.4 Invasive Species Control

Exotic plants and animals often thrive under conditions at wetland restoration sites (Zedler, 2000). A program for the control of non-native invasive plant species will be developed as part of the vegetation monitoring plan for this project (see Section 5.2.6). Control of aquatic invasive species is likely to be difficult and will be best achieved by providing conditions more favorable to native species.

4.5 Adaptive Management

Adaptive management means taking informed, intentional actions designed to achieve pre-defined goals and objectives, observing the effects of those actions over a prescribed time period, evaluating the observed outcomes of those actions against a set of pre-defined criteria, and determining whether further actions should be taken based on those evaluations (Lee, 1993). In this adaptive management framework, it is critical to consider up-front what range of *feasible* actions could be taken, so that monitoring and decision making are focused on elements where intervention is possible and likely to have a measurable effect.

Whether tidal inundation occurs at Blacklock under a planned or unplanned event, adaptive management will be incorporated, as needed, to meet project goals and objectives. Physical and biological parameters will be monitored to evaluate success in meeting desired outcomes and to minimize undesirable outcomes. Physical parameters including tidal regime and breach geometry will be used as an indicator for future actions. Monitoring these physical parameters, in addition to using the computer model as a predictive tool, will inform project planners on specific actions that might be implemented. One important component of biological monitoring will be the use of this restoration site by listed species. Adaptive management will be incorporated, as needed and practical, to meet the goal of providing suitable habitat for listed species.

Because the existing conditions of the exterior levees suggest that levee failure would occur in some location other than our preferred breach location, deepening or widening of the breach may be required to achieve full, unimpeded tidal flow. Under the unplanned breach scenario, site conditions will be monitored and observed for at least one year to allow time for evolution of the breach.

The Adaptive Management Program for the Blacklock Restoration Project consists of the following elements:

- Milestone #1: At one year following breach (whether planned or unintentional), results of several monitoring parameters will be evaluated to determine whether any further actions are needed: the degree of tidal inundation, amount of sedimentation, breach geometry evolution, vegetation community changes, mosquito production, and invasive species colonization. These data will inform whether levee breaches need to be enlarged, new levee breaches added, or invasive vegetation control needed.

- Milestone #2: At two years following implementation of any changes following review at Milestone #1, results of the same parameters plus overall wildlife use and aquatic species use will be evaluated. These data will inform whether any final measures are warranted to alter the course of the site development to promote meeting its goals and objectives.

- Monitoring data review: In between and following these two milestones, monitoring data will be reviewed along with site observations made during monitoring, for early detection of desired or undesirable outcomes. If these reviews indicate clear adverse conditions prior to reaching either milestone, actions under those milestones would be moved forward as deemed appropriate by DWR and its Advisory Team.

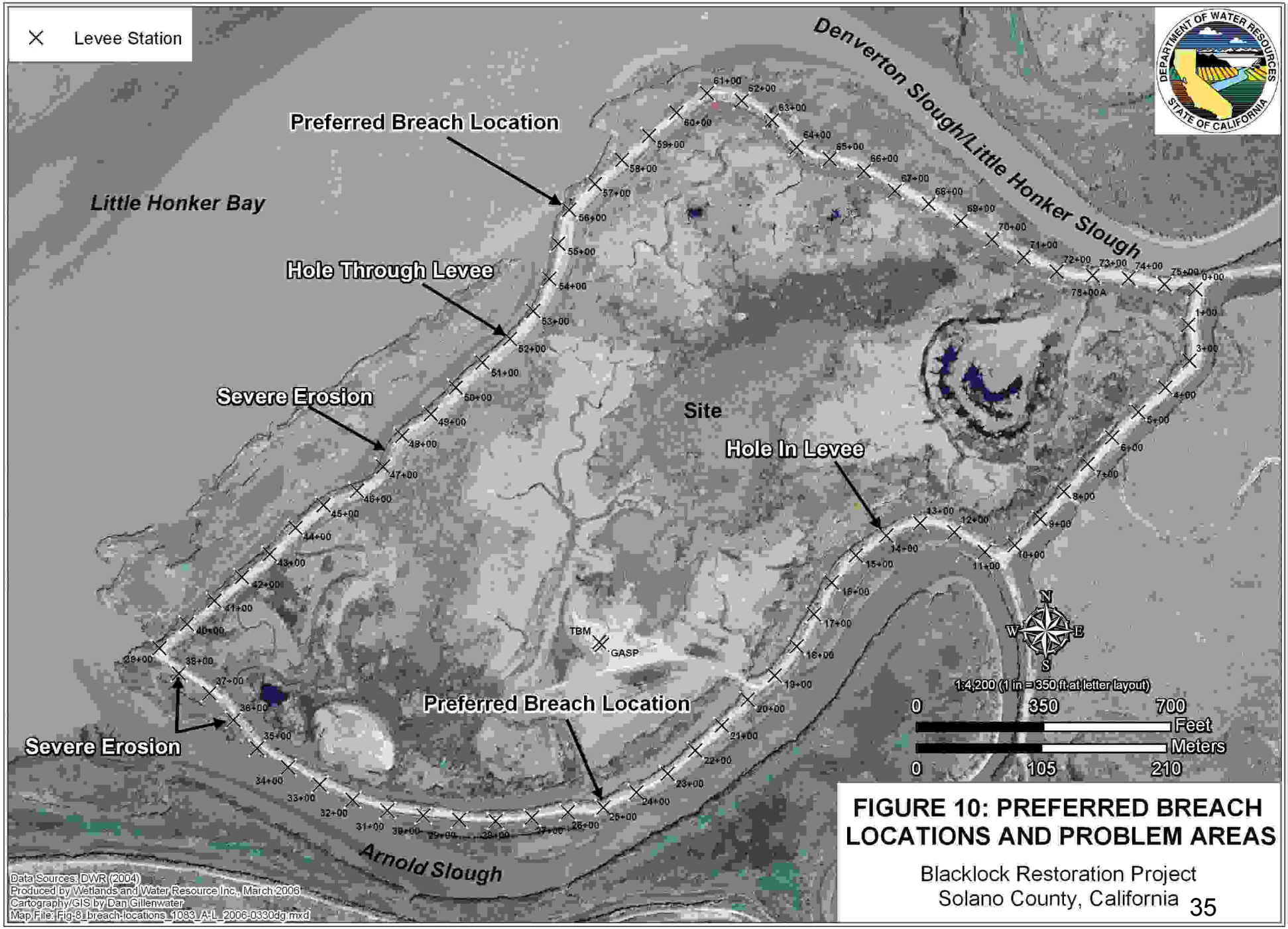


FIGURE 10: PREFERRED BREACH LOCATIONS AND PROBLEM AREAS

Blacklock Restoration Project
Solano County, California

Figure 11. Modeled Water Level at East Side of the Property, Node 4993, for Different Breach Sizes

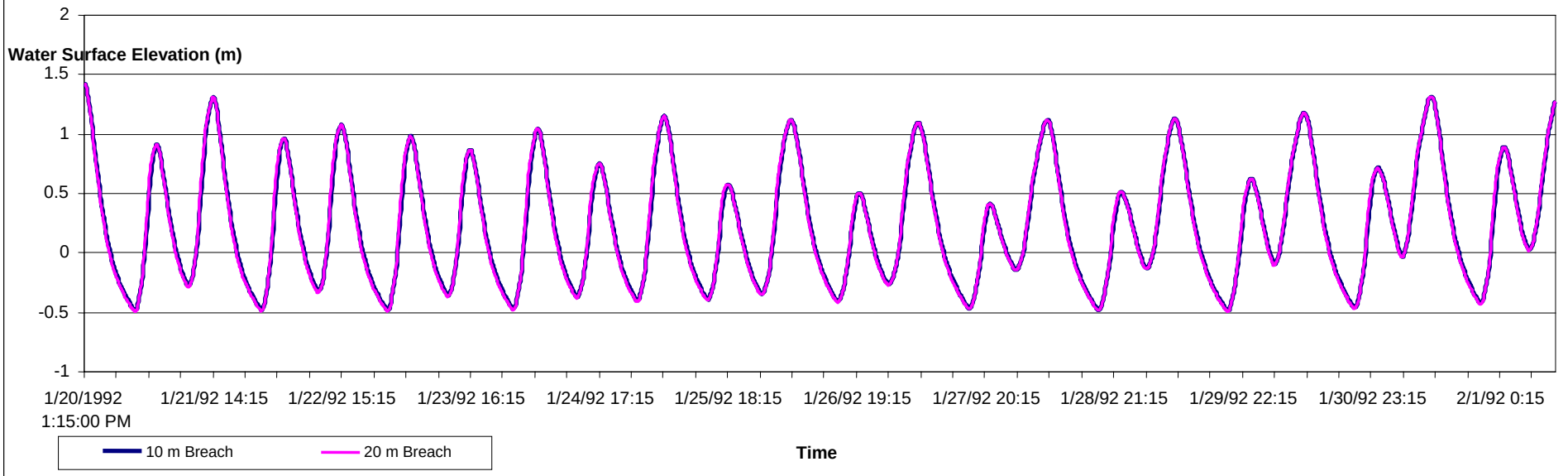


Figure 12. Modeled Water Level at West Side of the Property, Node 5457, for Different Breach Sizes

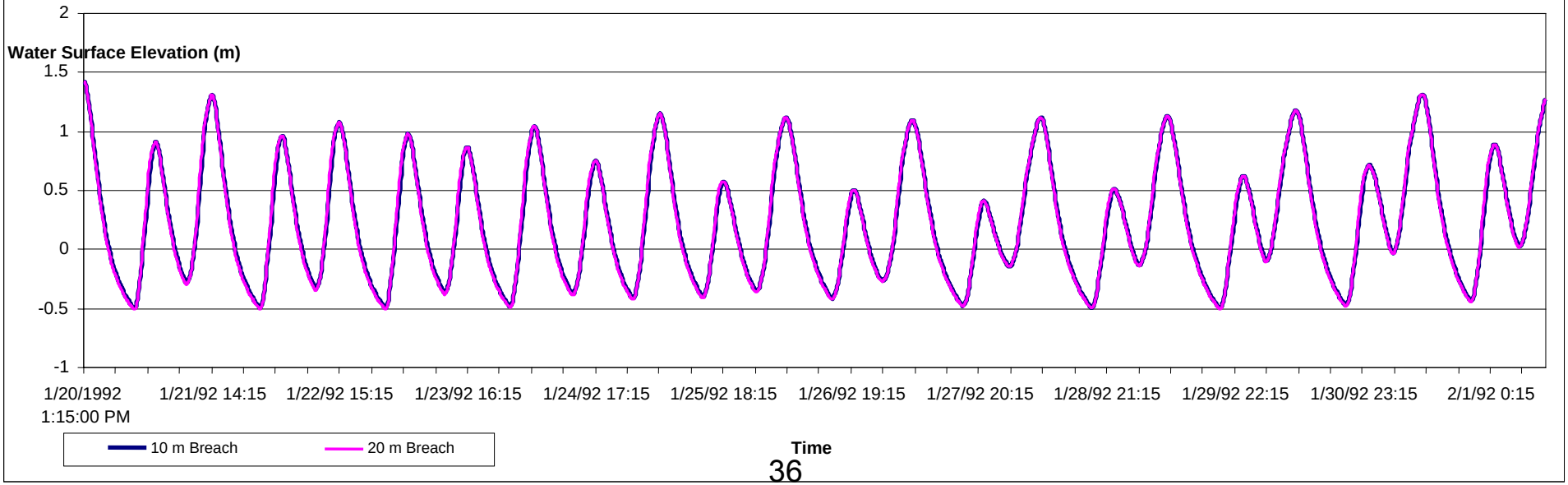


Figure 13. Modeled Water Level at East Side of the Property, Node 4993, for Different Breach Locations

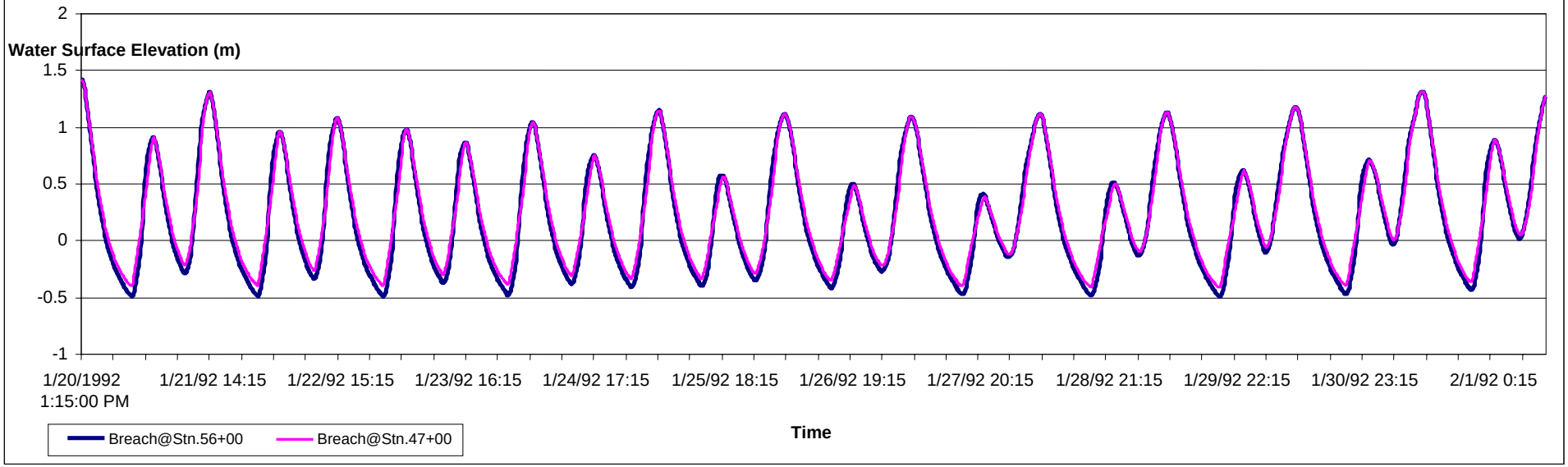


Figure 14. Modeled Water Level at West Side of the Property, Node 5457, for Different Breach Locations

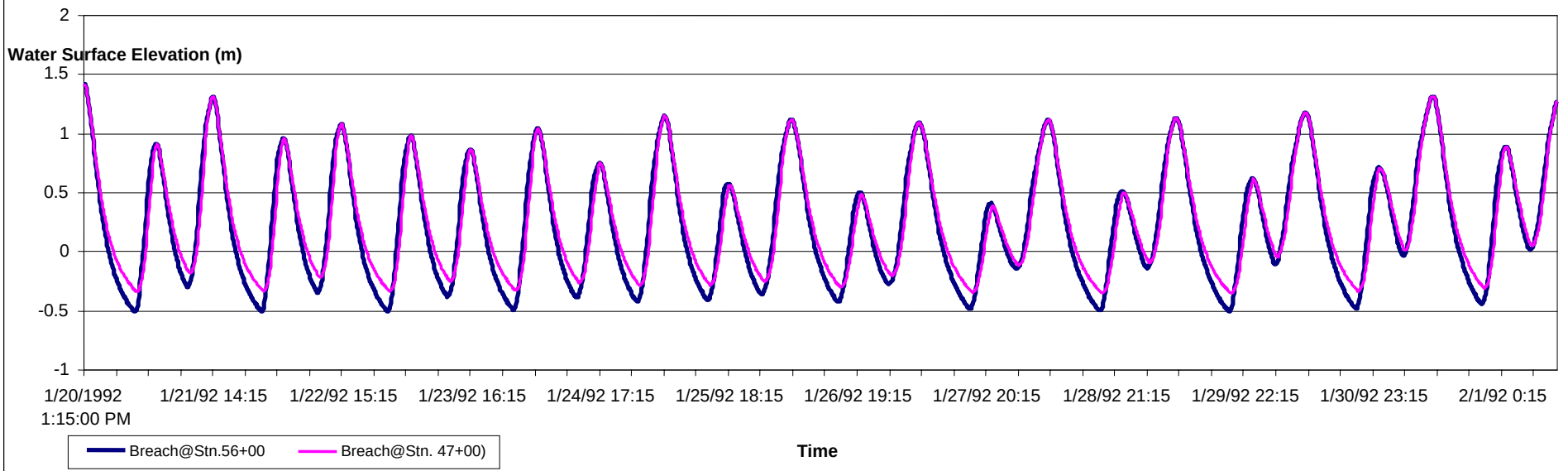


Figure 15. Modeled Water Level at East Side of the Property, Node 4993, for Different Number of Breaches

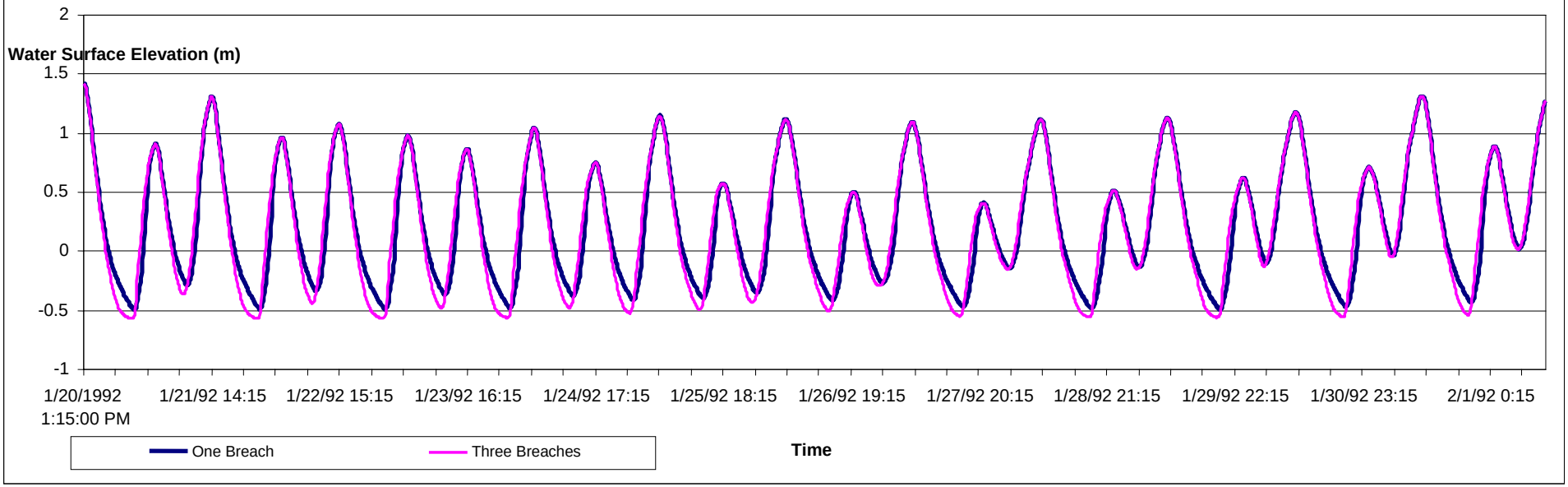


Figure 16. Modeled Water Level at West Side of the Property, Node 5457, for Different Number of Breaches

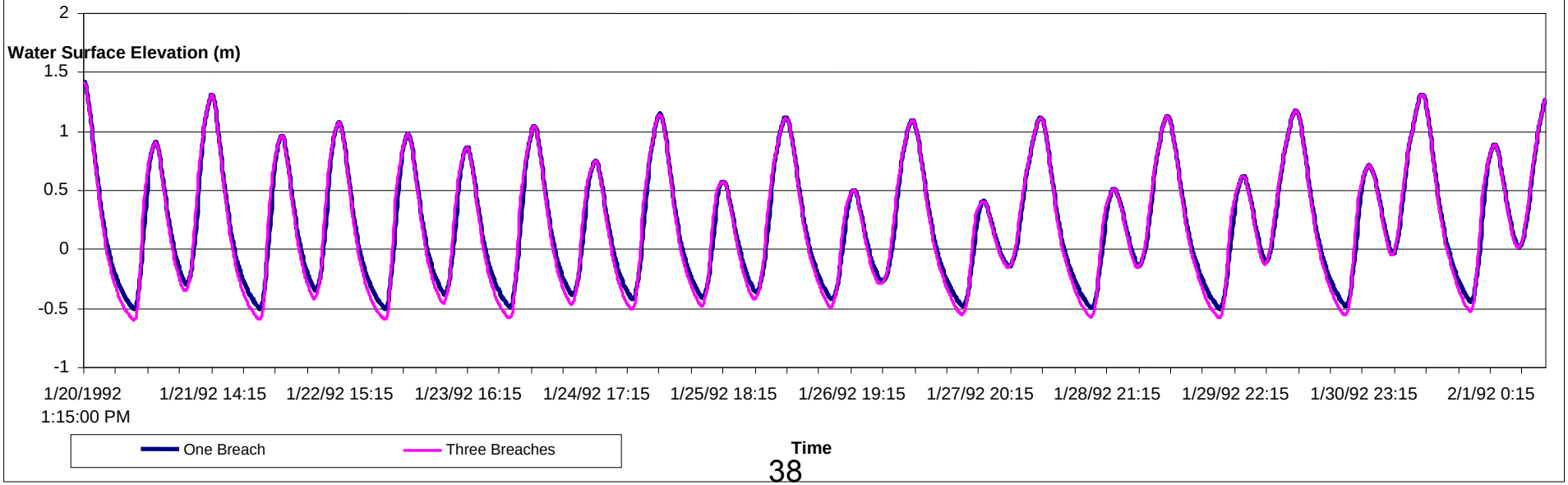


Figure 17. Modeled Water Level at East Side of the Property, Node 4993, for Different Manning's n

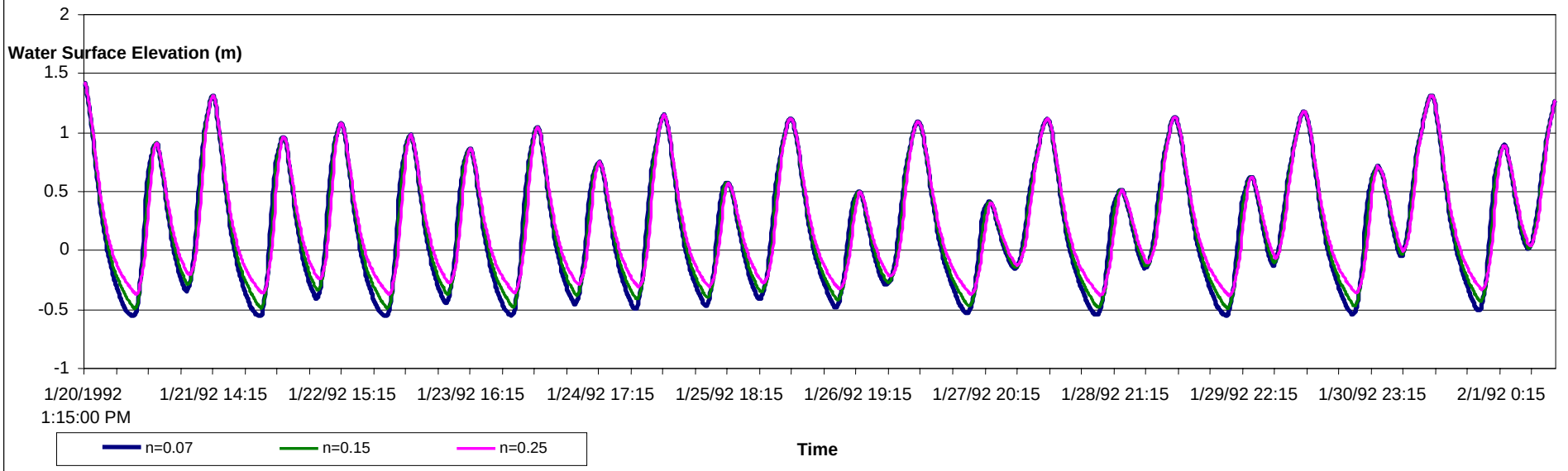


Figure 18. Modeled Water Level at West Side of the Property, Node 5457, for Different Manning's n

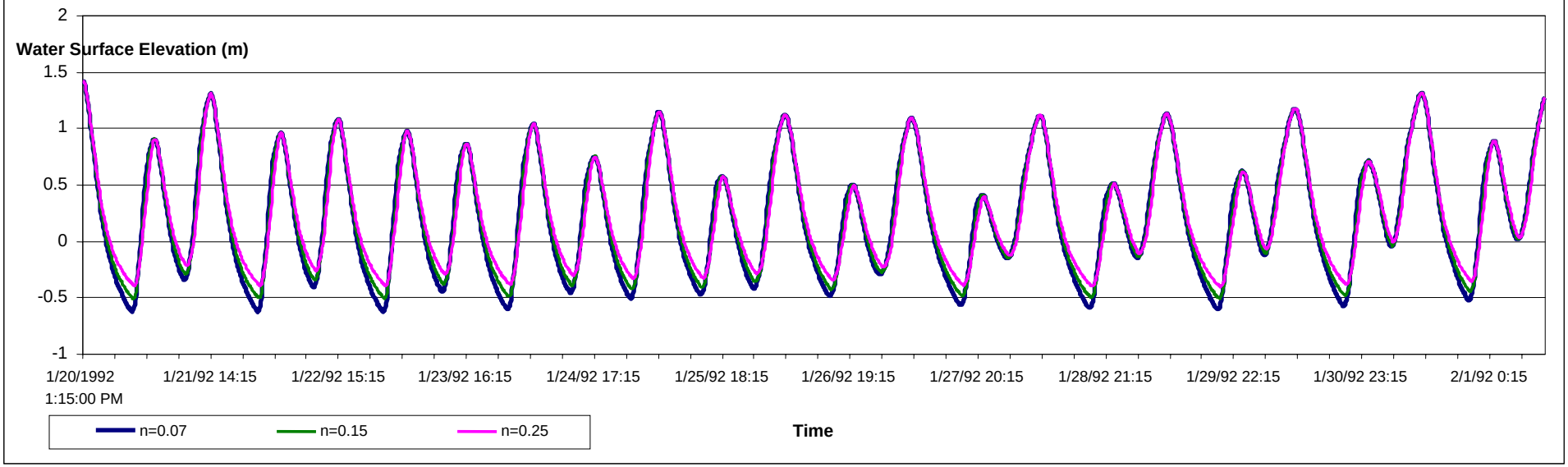


Figure 19. Modeled Comparison of Blacklock and Little Honker Bay Water Levels (One Breach)

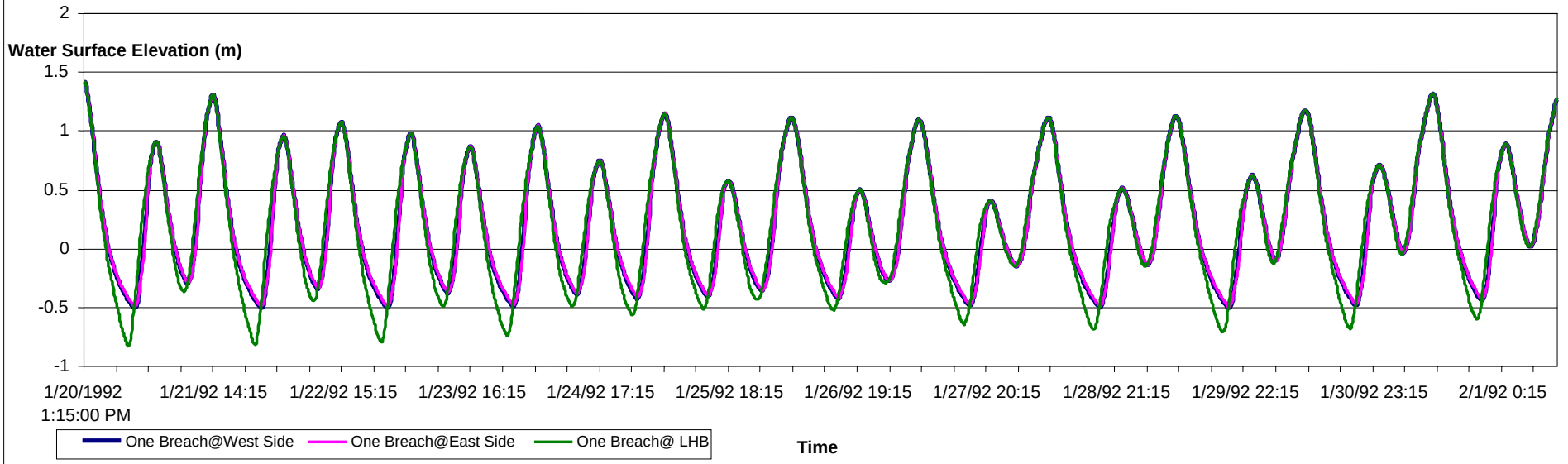
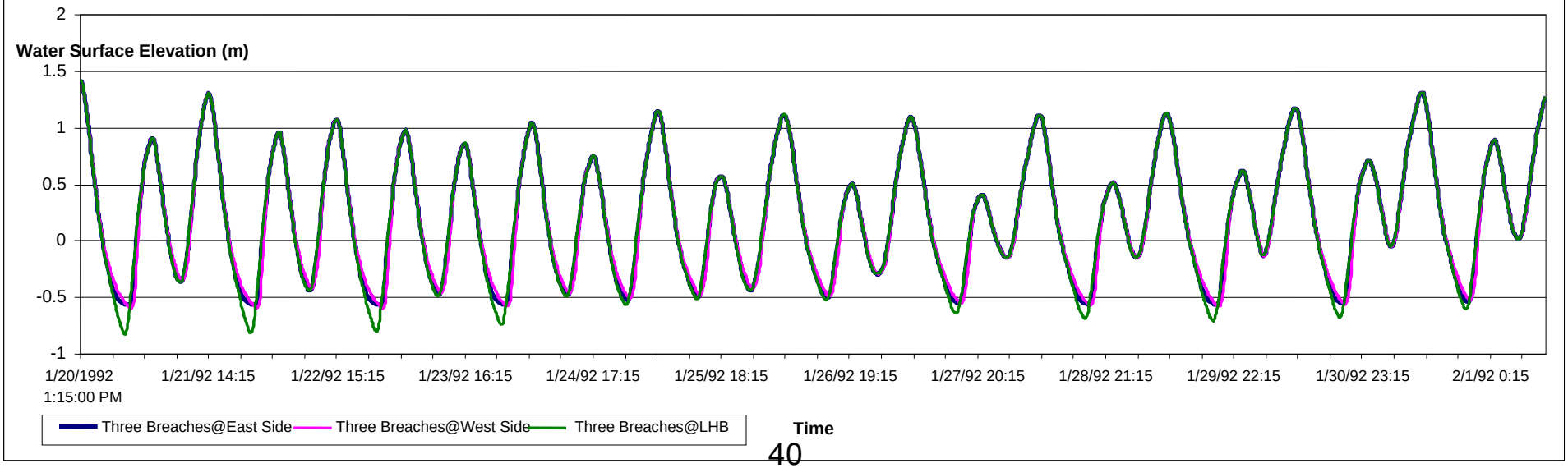


Figure 20. Modeled Comparison of Blacklock and Little Honker Bay Water Levels (Three Breaches)



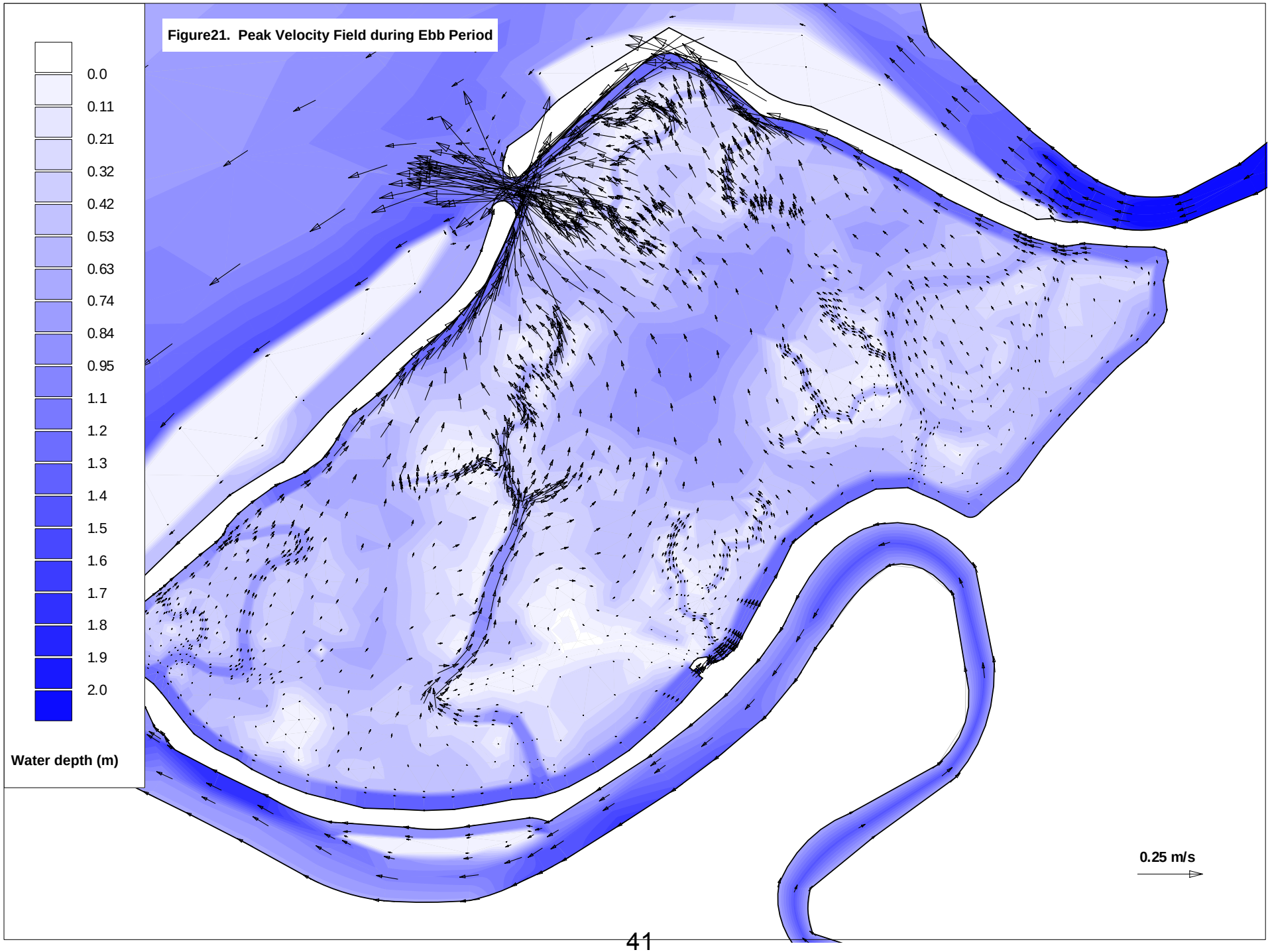


Figure21. Peak Velocity Field during Ebb Period
0.0
0.11
0.21
0.32
0.42
0.53
0.63
0.74
0.84
0.95
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
Water depth (m)
0.25 m/s

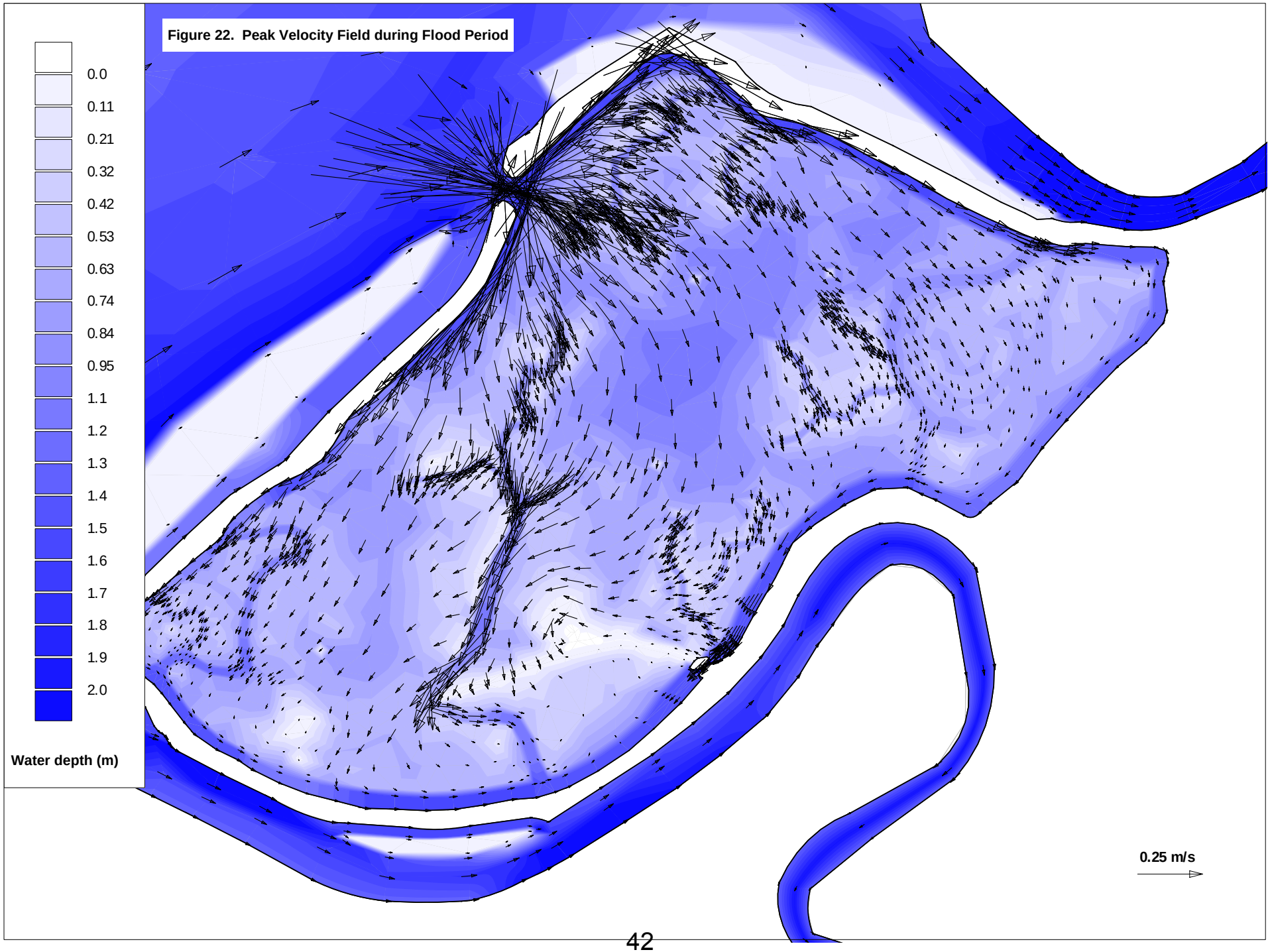


Figure 22. Peak Velocity Field during Flood Period
0.0
0.11
0.21
0.32
0.42
0.53
0.63
0.74
0.84
0.95
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
Water depth (m)
0.25 m/s

5.0 MONITORING

This section describes the monitoring program that will accompany the Blacklock Restoration Project. The goals identified for this project include: 1) restoration of the Blacklock parcel and 2) avoidance of adverse impacts from construction and restoration activities. A detailed monitoring plan will be prepared as part of NEPA/CEQA compliance and permitting.

5.1 Restoration Performance Criteria

The performance criteria for the Blacklock Restoration are:

- High tide heights inside the site will be substantially similar to those observed outside the site, within two years following a planned or unintentional breach.
- Low tide heights inside the site will be no more than 1 foot greater than those observed outside the site, within two years following a planned or unintentional breach.
- Restored marsh plain elevations will continually trend upwards.
- Native tidal marsh species will colonize and establish at the site. Total percent cover shall be at least 50%. Species composition will be those species appropriate to the salinity regime and site elevations.

5.2 Restoration Outcome Monitoring

Monitoring will both document the expected beneficial effects of this project and detect potential impediments to successful marsh restoration as well as potential adverse outcomes. Monitoring for each of the performance criteria will continue until performance criteria are satisfied. If performance criteria are not met, the causes will be investigated and adaptive management actions/corrective measures will be implemented.

Monitoring components include:

1) Inundation regime
2) Levee breach geometry
3) Surface elevation changes/sedimentation
4) Slough network evolution
5) Native marsh vegetation development
6) Invasive plant species establishment
7) Water quality including production of methyl mercury
8) Nurse Slough monitoring network
9) Aquatic species utilization
10) Wildlife use

A schedule of restoration outcome monitoring is presented in Table 5.

Table 5 - Restoration Monitoring Schedule

Section	Description	Year(s) for Each Monitoring Activity 1	Frequency During Years Monitored	Seasonal Timing
5.2.1	Inundation regime	Years 1, 2, 3, 5, 10	Continuous	Spring Tides (Jun - Jul or Dec - Jan)
5.2.2	Levee breach and outboard marsh channel geometry[3]	Years 1, 2, 3, 5, 10	Annual	With air photo
5.2.3	Substrate development SET measurements	a) Years 1- 3	Semiannual	winter, summer
		b) Year 4 to 25% native veg. cover	Annual	summer
		c) Begin at 25% native veg. cover, end at 75% native veg. cover	Once every 3 years	summer
	Substrate development Topographic Surveys	a) Years 1- 3	Semiannual	winter, summer
		b) Year 4 to 25% native veg. cover	Annual	summer
		c) Begin at 25% native veg. cover, end at 75% native veg. cover	Once every 3 years	summer
5.2.4	Channel network evolution	Years 1, 2, 3, 5, 10	Annual	With air photo and topographic surveys
5.2.5	Calculate veg. percent cover from air photo and ground truthing	a) Year 1 to 35% native veg. cover	Annual	Jul - Aug
		b) Begin at 35% native veg. cover, end at 75% native veg. cover	triennial	Jul - Aug
	Vegetation field surveys (transects and plots)	Begin at 25% native veg. cover, end at 75% native veg. cover	triennial	Jul - Aug
5.2.6	Invasive plant species establishment	Year 1 to 75% native veg. cover	three times per year	spring, summer, fall
5.2.7	Water Quality in adjacent sloughs/LHB (hydrodynamics, sediment, chlorophyll)	Baseline sampling prior to breach Continue through inundation, end at stable results	Continuous	
	Water Quality In adjacent sloughs/LHB (hydrodynamics sediment, chlorophyll, methylmercury)	30 hour drifter studies	pre breach post breach	TBD
	Water Quality (methylmercury)	Baseline sampling prior to breach Begin at inundation	TBD[2]	
5.2.8	Fish Occurance	Begin year 2 after inundation	Annual	TBD
	Fish Site Function	Begin year 3 after inundation	Annual	TBD
5.2.9	Wildlife use (SMHM)	Begin at inundation on levees, survey available suitable habitat, end when stable survey results achieved	Annual	Jun - Aug
	Wildlife use (shorebirds & waterfowl)	Years 1, 3	Quarterly	Win, Spr, Sum, Fall
	Wildlife use (shorebirds & waterfowl)	Years 5, 10	annually	TBD

Notes

1. Projected time estimates to achieve Performance Criteria, actual duration is dependent upon Performance Criteria (see Restoration Performance Criteria, Section 5.1).
2. Sampling protocols to be developed by Mark Stephenson, CDFG

5.2.1 Inundation Regime

Inundation regime will be evaluated by collecting the tide stage both inside and outside the property. Evaluation of the tide stage data will inform SMPA ECAT agencies on whether the project is achieving unimpeded tidal exchange which is a fundamental component of the restoration objectives.

DWR maintains a water quality monitoring station (BLL) along Little Honker Bay/Little Honker Slough as part of the California Data Exchange Center (CDEC) monitoring network. This station measures precipitation, water temperature, wind speed and direction, atmospheric pressure and stage hourly. A pressure transducer was installed on the pond side of the levee to monitor tide stage within the site. Data is telemetered to Sacramento so tide stage can be monitored remotely. Comparing the tide stage inside the site with that of the slough will indicate whether the restoration is achieving unimpeded tidal flow. If tides are unimpeded, then the tide stage inside the site will be nearly identical to that which is measured in the adjacent slough. If tides are constricted, then the tide height inside the sit will be lower than outside; reduced height of high tides inside the site will provide a simple indicator of this problem. If low tides inside the site are higher than that of the adjacent slough, this indicates that the site does not drain effectively.

5.2.2 Levee Breach Geometry

Planned breaches would be designed for unimpeded tidal flow at the time of construction. If breaches are constructed as designed, the breaches may erode naturally in the early development stage then it may sediment in as the site's tidal prism decreases with overall sedimentation. Cross-sectional profiles would be conducted as soon as construction is complete.

With an unintended breach, natural erosion is also expected to occur until equilibrium conditions (stabilized breach size) are achieved. Evolution of an unplanned breach is dependent on the mechanism of the initial levee failure, the size and condition of the levee, and the levee material at the location of the unplanned breach. Cross sectional profiles will be conducted as soon as is practical after the breach occurs.

Periodic cross sectional profiles will be conducted of the breaches to document tidal scour or sedimentation and aid management decisions regarding breach maintenance. The timing of surveys will be dependent upon observed changes of the breach.

With an unintended levee failure, it will be imperative to evaluate breach geometry data closely in conjunction with tidal inundation data to assess if restoration goals are being achieved. If goals are not being achieved, adaptive management/corrective measures would likely include modifying the breach or breaching the levee in another location.

5.2.3 Surface Elevation Changes/Sedimentation

To meet the project goals of restoring tidal marsh, sedimentation must occur within the subsided Blacklock property. Naturally deposited sediment aided by accumulation of plant detritus forms the substrate that is essential to plant establishment and growth and it provides the environment required by benthic organisms. One of the proposed breach locations was selected in part because of its proximity to Little Honker Bay. It is expected that Little Honker Bay will provide a sediment source for the Blacklock restoration site.

Baseline sediment concentrations were monitored in both Little Honker Bay and Arnold Slough using optical backscatter (OBS) instrumentation. This data collection effort conducted by San Francisco State University (Snow, in press) concluded that:

1) There are temporal differences in suspended sediment concentrations and that the most significant differences are seen at the seasonal level.
2) The highest concentrations are seen in the summer time and can be attributed to re-suspension of sediment by wind (Cuetara, et al. 2001). The second highest levels are in winter and are related to runoff from the rainy season.
3) The leveling off of the sediment concentrations in the early spring may represent when sediment supply from runoff is exhausted and the following increase in late spring, early summer represents a transition to a new source of sediment.
4) No obvious relationship was evident between monthly tidal variations and sediment concentrations.
5) There is a tidal relationship between water level and sediment concentration. On the rising limb of the tide the suspended sediment concentrations also rise and on the falling limb of the tide the sediment concentrations lower.

At the request of DWR modelers, the OBS in Little Honker Bay will remain in place for an additional six months to collect additional data for the sediment transport model. This instrument was removed in May 2006.

Sediment accumulation on the site will be monitored with Sediment Erosion Tables (SET's) installed and periodic topographic surveys. The topographic surveys, at fixed locations will be conducted periodically to assess elevation changes.

Three SET's have been installed throughout the site as shown on Figure 5. The SET's were placed in three distinct habitat types throughout the site. One was placed within emergent vegetation in the southwest area of the parcel, a second was placed in an existing pond, and the third placed in a slightly higher area within a large area of salt grass, near the northeast corner of the parcel.

Vertical accretion of sediments will be measured and compared with baseline data that was collected prior to the breach. The SET (Calhoun et al, 2002) consists of an arm temporarily inserted into a survey rod secured in a concrete filled PVC pipe. Pins are then inserted through a plate on the arm and successive measurements track changes in marsh surface elevation relative to the base of the pipe. A sampling structure was constructed at each SET location prior to inundation to prevent disturbance of the surface where measurements are made. To account for possible settlement of the SETs themselves, which may occur because the weight of the concrete used to install them could cause them to sink in the soft peat soils, the benchmark on each SET will be surveyed to a known nearby benchmark at each SET measurement event.

In addition to SET measurements, feldspar marker horizons were installed at each SET and cryogenic core samples will be extracted from the feldspar locations. Data from the SET and feldspar marker horizons together allow for direct measurements of sediment accretion at the site.

5.2.4 Slough Network Evolution

To support the diverse fish and wildlife communities expected to use the restored tidal marsh, a slough channel network must be maintained or created. In addition, an effective slough network is necessary to maintain the hydrology on site and support tidal exchange throughout the property.

While there is an existing slough network on the site, the location of the breach may result in flows altering the configuration of sloughs within the property and these sloughs are all many feet below marsh pain elevations. Changes in the slough network will be monitored using aerial photography. Parameters to be measured include total surface area of channels, areas of expansion and loss, and changes over time. Aerial data will be

supplemented with topographic cross-sections of selected areas. This data is essential for calibration and verification of the computer model.

5.2.5 Native Marsh Vegetation Development

Vegetation development will be monitoring annually to assess if native tidal marsh vegetation develops consistent with the performance criteria developed for this project. Plant community evolution will be measured as percentage change in aerial extent as well as conformity with local native plant diversity found in the region.

While there is extensive native marsh vegetation currently on the site, it is expected that some of that will die off during tidal inundation. Some emergent species will likely survive inundation and continue to colonize throughout the site. The die off of vegetation as a result of inundation will provide material for substrate formation.

Vegetation monitoring will consist of digital and field examination of ortho-rectified aerial photos. Evolution will be measured as a change in percent cover and species over time. Species composition will be monitored and changes noted, using the classification system established by DFG.

Aerial photos will be shot in June or July to correspond with the aerial surveys conducted as part of the Suisun Marsh Vegetation Survey (DFG, 1999 and 2003) Survey methodology established for the Suisun Marsh Vegetation Survey will be implemented.

Additional information about tidal marsh development and functions may be informed by establishing permanent transects and plots after marsh development occurs and vegetation colonizes the site.

5.2.6 Control of Invasive Plant Species

Colonization of the Blacklock restoration site by non-native invasive plant species would jeopardize meeting the objectives of the restoration. Many of the important ecological benefits of restored tidal marsh vegetation will not be provided by invasive species. Specifically, colonization by invasive non-native plant species may prevent establishment of native tidal marsh vegetation.

Monitoring and control of non-native invasive plant species will focus on two invasive plants that are particularly problematic in Suisun-*Phragmites australis* and perennial pepperweed (*Lepidium latifolum*). Lepidium is a problem throughout Suisun marsh, however, it has not been found at Blacklock to date. When and if pepperweed is found on the site, control methods, including herbicide use, will be employed to prevent its establishment at the site. DWR staff will consult with weed management specialists to identify the most appropriate control method.

Annual surveys for non-native invasive plant species will be conducted. In addition, field personnel will be encouraged to report any occurrences of pepperweed to weed control specialists for immediate treatment, if appropriate.

The spread of phragmites is a problem throughout Suisun Marsh and control experiments are ongoing. As in other managed wetlands, populations of phragmites have become established at Blacklock. The depth and duration of flooding with tidal inundation may help control the spread of this species (FWS, 1989). Monitoring will be conducted annually to determine any changes in phragmites cover. Alternative treatment techniques will be employed to control the spread of this species, if needed.

5.2.7 Water Quality including production of Methyl Mercury

Water quality changes, specifically changes in salinity and the production of methyl mercury, resulting from tidal inundation at Blacklock are of particular interest to DWR and other agencies involved in long term planning decisions in Suisun Marsh.

Hydrodynamic modeling conducted by DWR has suggested that breaching levees in Suisun has an effect on salinities both in Suisun Marsh and in the Sacramento San Joaquin Delta. The specific effects are dependent on the size and location of the breach and the area of inundation. Modeling of the Blacklock restoration shows changes in salinity in Montezuma Slough, both upstream and downstream of Nurse Slough. These changes were minor and are not expected to impact DWR's ability to meet SWRCB salinity standards for Suisun Marsh. DWR will continue to collect salinity data at the BLL monitoring station adjacent to the restoration. Dissolved oxygen, temperature, and EC will be collected within the restoration site as part of the fish monitoring program.

Wetlands are known to be areas of high methyl mercury production (Heim et al 2003, Davis et al 2003, Weiner et al 2003, Marvin De-Pasquale et al 2003). The factors that influence methyl mercury production are numerous and not well understood. However, there are three key factors that appear to be critical to net methyl mercury production. These factors include total mercury concentration, speciation of the mercury, and level of activity of methylating bacteria. Intertidal vegetated wetlands have been found to have significantly greater potential to methylate mercury than adjacent channels, mudflats, or open water (Marvin-DiPasquale et al 2003). While tidal wetland areas in Suisun Marsh and the Delta have been shown to be high producers of methyl mercury, production of methyl mercury in the managed seasonal marshes has not been well documented; limited sampling (Schroeter and Moyle, unpublished data, working with DFG) suggest in some instances that high methyl mercury concentrations can occur in managed wetlands discharges at times when that discharge water experiences low dissolved oxygen levels. Mark Stephenson, DFG Moss Landing is investigating methyl mercury issues in Suisun Marsh as part of a CALFED funded study. As part of comprehensive water quality sampling program described below in section 5.2.7.1, DFG is developing specific study protocol for investigating methyl mercury exports and Methyl mercury in sediments at Blacklock. Pre-project methyl mercury samples were collected in January 2004 following levee overtopping.

5.2.7.1 Nurse Slough Monitoring Network

DWR, DFG, and USGS are collaborating on an interdisciplinary study to observe physical and chemical response to a planned levee breach at the project site. This study represents a rare opportunity to study the before and after effects of a step change in geometry of a wetland slough complex. The study focuses on hydrodynamics, sediment, chlorophyll, and methylmercury dynamics of Nurse/Denverton Slough and the 70 acre Blacklock property. Instrumentation was deployed in February 2006 that is sufficient to characterize changes in water, sediment, chlorophyll, methylmercury and salt flux and residence time that may arise due to a Blacklock levee breach. Other likely collaborations in the planning stages prior to levee breach are related to dissolved oxygen dynamics, secondary production, fish usage, and toxics in invertebrate biomass. The study also complements concurrent analysis of Blacklock sediment and plant biomass accretion potential. Given existing plans for large-scale tidal restoration in Suisun Marsh, the experiment design offers the potential for significant elucidation of the impact of diked wetland tidal marsh restoration in the Nurse Slough complex, Suisun Marsh, and the larger San Francisco estuary.

Brief conceptual models and experiment questions

1. Hydrodynamics and transport: After the Blacklock levee breaches, the tidal prism of the Nurse Slough complex will increase by nearly the tidal prism volume of the property (approximately 160 acre-feet). This volume is approximately 4% of the tidal prism at the mouth of Nurse Slough. In situ ADCP's will detect this step change in the tidal flow regime. The 70 acre property will also induce a small tidal current asymmetry in

the timing between breach current and Little Honker Bay current. Preliminary modeling results suggest that flood tide velocity through a small levee breach would likely be relatively higher but shorter duration than ebb tide flows. This will result in some tidal salt trapping that will tend to mix the strong salinity gradient between Beldons Landing (on Montezuma Slough) Denverton Slough at Blacklock. A compression of the regional tidal datum from frictional energy dissipation on the relatively shallow property is expect as well as some modification of water residence time along the Nurse/Denverton Slough complex. Finally, since Nurse and Denverton Sloughs converge in a loop, the location of the tidal convergence may be induced to move in some unknown way.

Experimental questions include:

- How does nurse Slough residence time change at the tidal and spring-neap timescale due to the addition of Blacklock tidal prism?
- How much is regional salinity and tidal range affected by the additional tidal prism and change in current phasing?

Denverton Creek inflows and the position of the Nurse Slough mouth along the east-west salinity gradient of Montezuma Slough would tend to maintain the salinity gradient along Nurse and Denverton Slough. Given the nominal depth of the lower Nurse Slough reach (~30 ft), we would expect to observe at least periodic gravitational circulation. Addition of Blacklock hydrodynamics after levee breach could change the frequency and strength of density driven current dynamics with concomitant effects on sediment transport and sediment associated mercury transport.

Experimental questions include:

- Will the tidal prism of Blacklock be sufficient to mix the salinity gradient in Nurse Slough and change the characteristics of periodic gravitational circulation between lower Nurse Slough and Beldons Landing?

2. Sediment transport: After levee breach, Blacklock will accumulate local sediment due to elevated suspended sediment concentration in Little Honker Bay and the velocity asymmetry at the breach site. We will observe higher velocity, shorter duration flow (jet flow) on the flood tide that transports Little Honker Bay sediment into Blacklock. Ebb tide flows will be longer in duration, and exhibit lower velocities (potential flow). Therefore, some of the sediment that enters on the flood tide through the breach will settle out and/or be trapped by marsh plants. It is expected that a transient period when sediment flux will be significantly negative at the mouth of Nurse Slough will occur while Blacklock is accumulating sediment and Little Honker Bay is eroding in the region of the breach.

Experimental questions include:

- Will the ebb-flood velocity asymmetry at the levee breach erode and trap sediment from Little Honker Bay?
- Will there be enough energy in the levee breach to distribute sediment widely inside the Blacklock property to raise land elevation?

3. Methylmercury: Methylmercury is produced in low oxygen environments in the presence of sulfate reducing bacteria (like marshes). Elemental mercury likely accumulated with hydraulic mining debris on Blacklock in the late 1800s. The property was subsequently diked, partially encapsulating mercury on the site. Opening the site to tidal action will change mercury methylation dynamics. We assume that there will be a net export of the mercury stored in near-surface sediments at Blacklock. There could be a spike in methylmercury export for an unknown period that reduces asymptotically as time passes. Once in the open channel, methylated mercury may be further transformed (perhaps demethylated) due to the different light,

temperature, oxygen, and other chemical conditions. We will observe these transformations at the mouth of Nurse Slough.

Several instruments have been deployed in the Nurse Slough/Little Honker Bay area. Three permanent multi-parameter stations (water level, temperature, salinity, plus one with meteorology) were deployed to monitor the salinity gradient along Montezuma and Nurse Slough. Nearby permanent stations exist at Beldons Landing, Montezuma Slough near the salinity control gate, and adjacent to the property on Denverton Slough. Doppler current profilers and multi-parameter water quality instruments were deployed in January 2005 in the mouth of Nurse Slough, the western branch of Nurse Slough, and Denverton Slough along the northern edge of the Blacklock property. An additional Doppler current profiler and multi-parameter instrument were deployed on May 1, 2005 at the mouth to improve flux estimates. The deployment will be maintained for at least one year to capture tidal, fortnight, and seasonal constituent flux dynamics. These instruments will be sufficient to measure water, sediment, methylmercury, chlorophyll, temperature, dissolved oxygen, and salt fluxes. We will observe all parameters for approximately six months prior to levee breach, then observe changes in these quantities after the levee breach (approximately September 2006). Nurse Slough and Denverton Slough come together north of Bradmoor Island forming a loop. Doppler current profilers and multi-parameter sondes deployed on the Nurse Slough and Denverton Slough branches will capture the dynamics of the hydrodynamic/transport convergence.

One multi-parameter sonde will be deployed inside the Blacklock property (as near to the levee breaches possible) to measure the suspended sediment concentration, chlorophyll, and salinity and thus establish gradients in those quantities between Blacklock property and Little Honker Bay. Sediment flux will be estimated by measuring sediment concentration in Little Honker Bay near the breach, and estimating tidal flows with water level observations and estimates of change in storage. Sediment flux estimates through the breach will be used in conjunction with measured sediment accumulation on existing sediment erosion tables to estimate long-term spatial and temporal accumulation of sediment at Blacklock. The internal sonde will also log chlorophyll fluorescence for comparison to the same quantity at the mouth of nurse Slough to deduce Blacklock's contribution to the phytoplankton budget.

Two 30-hour studies will be conducted to intensively measure currents, sediment transport, chlorophyll, and methylmercury at key locations in the Nurse Slough complex. This effort serves to calibrate in situ instruments, generate high-resolution suspended sediment dynamics (from ADCP acoustic backscatter intensity), pinpoint hydrodynamic exchange dynamics between Nurse Slough and Montezuma Slough, and give us a reason to stay up all night. Passive drifters will be released in such a way as to measure tidal excursion distance and ultimately deduce water residence time as a function of position along Nurse Slough.

This effort offers a reasonable opportunity to expand the knowledge base on several important issues. It is expected that peer-reviewed papers will be prepared on the following topics:

1. Methylmercury production from breaching levees on formerly diked wetlands.
2. Chlorophyll production and quality both on the Blacklock site, and downstream at the mouth of Nurse Slough.
3. The salinity mixing impact of levee breaches.
4. Residence time and the spatial/temporal contribution of slough complexes to the estuarine food web.
5. Sediment accumulation on formerly diked and subsided wetlands.

5.2.8 Fish

Desired outcomes of the restoration of Blacklock to tidal marsh are to provide habitat for native fishes and aid in the recovery of listed fish species in Suisun Marsh. In a review of information regarding native fish use of

restored freshwater tidal wetlands, Brown (2003) concluded that restoring tidal wetlands my not provide as great a benefit to native fish populations as originally expected. Studies of tidal marsh restoration sites in the Delta have found statistically higher density of native fish at reference sites as compared to the restored sites (Simensted et al. 2000). This suggests that the restored sites do not provide the same habitat value as the historic tidal wetland. Similar studies conducted for BREACH at sites in Suisun Marsh do indicate potential for native fishes benefits (Simenstad, unpublished data). Further, Dr. Peter Moyle of UC Davis, who has conducted more than 25 years of fish monitoring in Suisun Marsh, has stated his belief that tidal marsh restoration in Suisun Marsh could provide important benefits to native fishes (CALFED Science Conference, 2004). It is likely that native fish would benefit from tidal marsh restoration as has been demonstrated in other areas (Miller and Simenstad 1997, Miller and Sadro 2003, Schreffler et al 1990, Simensted et al. 1993).

Following breaching of the site it will take several decades for the restored wetland to develop and mature. During this period the marsh will shift from allochthonous (outside) to autochthonous (within) biotic production. This shift will affect the ability of the habitat to provide adequate food-chain support. The goal of the fisheries monitoring is to assess the change in habitat value of the Blacklock restoration site to native fishes over time. Specific questions to be addressed include:

- Is there a difference in fish assemblage at the restored and reference sites?
- Does the fish assemblage (species type and abundance) vary with habitat type?
- How do fish support functions (phytoplankton production, invertebrate composition and abundance, vegetation, tidal hydrology, etc.) vary between the restored and reference sites?

Monitoring will document both site progression from year to year and site function during 'checkpoint' years. Monitoring will begin two years after the initial levee breach. This will allow time for the site to adjust to the changed conditions and begin the shift from external to internal production. Monitoring of fish occurrence and abundance will begin in year two and continue on a yearly basis as shown in Table 6. Monitoring of site function will begin in year three and continue on a triennial basis (Table 6). This monitoring will include an assessment of fish diet and growth rates. Monitoring for fish habitat function is critical as monitoring fish occurrence and abundance exclusively can provide misleading information on the progress of the restoration project (Callaway 2001). Monitoring frequency and duration will be determined by available funding.

5.2.9 Wildlife

DWR anticipates that restoration of Blacklock to tidal marsh will provide long-term ecological benefits to tidally dependent wildlife species. After tidal inundation, it is expected that habitat will be available for waterfowl and shorebirds. However, it is anticipated to take several years of sediment accretion for marsh elevations to raise enough to provide habitat for terrestrial species. Once surface elevations rise, and vegetation colonizes, it is expected that Blacklock will develop into a fully functioning tidal marsh with suitable habitat for marsh dependent wildlife species, including black rails and salt marsh harvest mice. As sedimentation rates slow with increasing elevations and the site is bordered entirely by steep levee, high marsh dependent species such as the black rail and SMHM may require many years before extensive suitable habitats develop at Blacklock.

DWR and/or DFG will monitor waterfowl and shorebird uses of the Blacklock restoration using standard protocols (Point Reyes Bird Observatory protocols for monitoring birds in tidal marsh as described in Nur 2005). These surveys will begin within one year of breaching and will continue quarterly at both low and high tide to track shorebird and waterfowl use of the ponds. Non threatened and endangered bird species monitoring will end five years after breaching.

Black rail have also been detected on site, under its current management regime. Black rail require well-vegetated high-marsh and marsh-upland transition zones. Therefore, it is expected to take several years for this habitat to establish at the Blacklock restoration site. Monitoring for black rails will take place as part of the waterfowl and shorebird surveys. If rails are detected, additional surveys can be scheduled. Other targeted wildlife species include Suisun song sparrow (*Melospiza melodia maxillaris*), marsh wren (*Cistothorus palustris*), common yellowthroat (*Geothlypis trichas*) and other avian species.

After tidal inundation, SMHM trapping at Blacklock will be conducted annually, on any available habitat and will continue as habitat develops on the site. SMHM surveys will continue until populations are stable. Just prior to the levee breach (constructed), the breach locations will be surveyed following USFWS protocol. Immediately post-breach, traps will be set in all available un-inundated areas (which may only be the levee) to capture rodents as they leave the site. These traps will be set for approximately two weeks to assess movements and residence times of rodents in the un-inundated areas. Trapping protocol will be similar to protocol used by DWR and DFG in their existing marsh wide SMHM surveys.

Table 6 Post Breach Fish Monitoring Schedule

Description	Annually beginning year 2												Triennally beginning year 3											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
On-Site Restoration Monitoring																								
Fish occurrence and abundance			M	M	M	M	m	m	m						M	M	M	M	m	m	m			
Fish diet																M	M		m					
Fish growth rate																M	M		m					
Invertebrate density and diversity																M	M		m					
Off-Site Reference Site Monitoring																								
Fish occurrence and abundance															M	M	M	M	m	m	m			
Fish diet																M	M		M					
Fish growth rate																M	M		m					
Invertebrate density and diversity																M	M		m					

M = sample once per month

m = omit if funds are insufficient

6.0 FINAL DESIGN AND IMPLEMENTATION ACTIVITES

This section describes the remaining tasks that will need to be completed to support the final design and implementation activities. The schedule for completion of the Blacklock restoration project is presented in Table 7. This schedule is preliminary and subject to change. Factors that may affect the schedule include whether an unintended levee breach occurs prior to completion of the plan and implementation of the planned breach, delays in permit acquisition, funding, and availability of staff resources.

Table 7- Preliminary implementation schedule-

April-06	Complete Restoration Plan
May-06	Complete Detailed Monitoring Plan including cost estimates
May-06	Complete Review of Draft Restoration Plan (CDBA, Blacklock Advisory Team
Spring 2006	Complete CEQA documentation.
Spring 2006	Prepare Environmental Permits/ ESA consultations
Sping/Summer 2006	Endangered Species Consultation
September-06	Complete Environmental Permitting (Final Restoration Plan) and NEPA compliance
September-06	Breach Levee
October-06	Begin post-implementation restoration monitoring

6.1 NEPA/CEQA compliance

DWR, with cooperation with the SMPA ECAT agencies, will prepare a joint Environmental Assessment/Initial Study to evaluate and assess the environmental impacts of this project. If appropriate, a Draft Negative Declaration (or Mitigated Negative Declaration) will be filed with the Governors office of Planning and Research and a Finding of No Significant Impact will be submitted to the federal register for review. DWR is the CEQA lead for this project. USBR is the NEPA lead.

6.2 Environmental Permitting

The following regulatory requirements apply to this project:

- San Francisco Bay Conservation and Development Commission
- Clean Water Act Section 404 Nationwide Permit 27 (US Army Corps of Engineers)
- Section 401 Water Quality Certification (RWQCB)
- Section 7 Endangered Species Act
- California Endangered Species Act

6.3 Monitoring Plan

DWR, in coordination with the Project Work Team participants, will prepare a detailed monitoring plan. This plan will include detailed description of post breach aquatic, vegetation, wildlife, avian, sediment and water quality monitoring. The Monitoring Plan will follow the December 20, 2004 USACE Mitigation and Monitoring Guidelines, as appropriate.

6.4 Final Restoration Plan

Following application for permits and incorporation of any changes based on comments during the permitting, a final restoration plan will be prepared. The Final Plan will identify the design to be constructed.

6.5 Construction plans and specifications

Following completion of permitting and the Final Restoration Plan, construction plans and specifications will be prepared suitable for field implementation by a contractor.

6.6 Construction

Construction will take place between June 1 and September 30 to correspond with the Suisun Marsh construction and maintenance season, as recommended by BCDC and specified by USACE RGP 24215N (or subsequent permit) and described in the Suisun Marsh Management Program.

Monitoring will commence after construction occurs, as detailed in the post-implementation monitoring plan (described above).

6.7 Funding

Additional funding will be required to implement a post-implementation monitoring program.

7.0 REFERENCES

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APPENDIX A

Blacklock Restoration Project Work Team

Cecilia Brown	US FWS	ECAT, ESA issues
Jon Burau	USGS	Hydrodynamics, transport, water quality
Steven Chappell	SRCD	ECAT, interim management, maintenance
Chris Enright	Ca DWR	Hydrodynamics, sediment transport
Cassandra Enos	Ca DWR	ECAT, Fisheries, Interim Management
Terri Gaines	Ca DWR	Project management, plan devel, permitting, etc.
Jeff Hart	Hart Restoration	Revegetation, brush boxes
James Kulpa	WWR	Surveying, SET
Leonard Liu	PRBO Cons. Science	Avian surveys
Jim Long	Ca DWR	Fisheries
Aaron Miller	Ca DWR	modeling
Nadav Nur	PRBO Cons. Science	Avian surveys
Laura Patterson	Ca DWR	Wildlife, SMHM
Patty Quickert	Ca DWR	ECAT Wildlife, SMHM trapping
John Robles	USBR	ECAT, NEPA
Eliza Sater	formerly Ca DWR	Fisheries
Leonard Sklar	SFSU	Sediment availability and transport
Randall Smith	Ca DWR	Surveying
Mark Stephenson	Ca DFG	methyl mercury
Jim Sung	Ca DWR	Levee maintenance, design, repair
Mary Snow	SFSU	Sediment availability
Gina VanKlompenburg	Ca DFG	ECAT Suisun Marsh restoration planning
Bruce Wickland	SRCD	Interim management, maintenance
Jean Witzman	Ca DWR	Vegetation, invasive species control
Xiaochun Wang	Ca DWR	Modeling

APPENDIX B

Blacklock Restoration Advisory Team

Project Manager
Terri Gaines
Staff Environmental Scientist
California Department of Water Resources

Science Advisor
Dr. Stuart Siegel
Wetlands Ecologist
Wetlands and Water Resources

Hydrodynamic Modeling, Water Quality, Sediment Transport
Christopher Enright
Senior Engineer
California Department of Water Resources

Sediment Availability and Transport
Dr. Leonard Sklar
Professor of Geoscience
San Francisco State University

Wetland Ecology, Soils
Dr. Steve Culberson
Staff Environmental Scientist
(formerly DWR)
CBDA Science Program

Fisheries, Interim Management
Cassandra Enos
Staff Environmental Scientist
California Department of Water Resources

Interim Management Advisor, Levee Maintenance
Steven Chappell
Executive Director
Suisun Resource Conservation District

Wildlife
Laurie Briden
Wildlife Biologist
California Department of Fish and Game

NEPA, permitting
John Robles
Environmental Specialist
U.S. Bureau of Reclamation

Wildlife, Fisheries, ESA
Cecilia Brown
Biologist
U.S. Fish and Wildlife Service

APPENDIX C

U.S. Fish and Wildlife Service Species List
Document # 060330024152

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

March 30, 2006

Document Number: 060330024944

Terri Gaines
Ca Department of Water Resources
3251 S Street
Sacramento, Ca 95816

Subject: Species List for Blacklock Restoration Project

Dear: Ms. Terri Gaines

We are sending this official species list in response to your March 30, 2006 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be June 28, 2006.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found at www.fws.gov/sacramento/es/branches.htm.

Endangered Species Division

TAKE PRIDE IN AMERICA

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species
that Occur in or may be Affected by Projects in the
DENVERTON (481B)
U.S.G.S. 7 1/2 Minute Quad
Database Last Updated: March 1, 2006
Document Number: 060330024152

Listed Species

Invertebrates

Branchinecta conservatio - Conservancy fairy shrimp (E)
Branchinecta conservatio - Critical habitat, Conservancy fairy shrimp (X)
Branchinecta lynchi - Critical habitat, vernal pool fairy shrimp (X)
Branchinecta lynchi - vernal pool fairy shrimp (T)
Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)
Elaphrus viridis - Critical habitat, delta green ground beetle (X)
Elaphrus viridis - delta green ground beetle (T)
Lepidurus packardi - Critical habitat, vernal pool tadpole shrimp (X)
Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus - Critical habitat, delta smelt (X)
Hypomesus transpacificus - delta smelt (T)
Oncorhynchus mykiss - Central Valley steelhead (T)
Oncorhynchus tshawytscha - Central Valley spring-run chinook salmon (T)
Oncorhynchus tshawytscha - winter-run chinook salmon, Sacramento River (E)

Amphibians

Ambystoma californiense - California tiger salamander, central pppulation (T)
Rana aurora draytonii - California red-legged frog (T)

Reptiles

Thamnophis gigas - giant garter snake (T)

Birds

Haliaeetus leucocephalus - bald eagle (T)
Rallus longirostris obsoletus - California clapper rail (E)

Mammals

Reithrodontomys raviventris - salt marsh harvest mouse (E)

Plants

Cordylanthus mollis ssp. mollis - soft bird's-beak (E)
Lasthenia conjugens - Contra Costa goldfields (E)
Lasthenia conjugens - Critical habitat, Contra Costa goldfields (X)

Candidate Species

Fish

Oncorhynchus tshawytscha - Central Valley fall/late fall-run chinook salmon (C)

Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run chinook (C)

Key:

(E) *Endangered* - Listed (in the Federal Register) as being in danger of extinction.
(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.
(P) *Proposed* - Officially proposed (in the Federal Register) for listing as endangered or threatened.
(NMFS) Species under the Jurisdiction of the National Marine Fisheries Service. Consult with them directly about these species.
Critical Habitat - Area essential to the conservation of a species.
(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.
(C) *Candidate* - Candidate to become a proposed species.
(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, or may be affected by projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regard-less of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the quad or quads covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the nine surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All plants and animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compen-sates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our critical habitat page for maps.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be June 28, 2006.

APPENDIX B

U.S. Fish and Wildlife Service Species List
Document # 060628031256

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species
that Occur in or may be Affected by Projects in the
DENVERTON (481B)
U.S.G.S. 7 1/2 Minute Quad
Database Last Updated: May 5, 2006
Document Number: 060628031256

Species of Concern - The Sacramento Fish & Wildlife Office no longer maintaina a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. See www.fws.gov/sacramento/es/spp_concern.htm for more information and links to these sensitive species lists.

Red-Legged Frog Critical Habitat - The Service has designated final critical habitat for the California red-legged frog. The designation became final on May 15, 2006. See our map index.

Listed Species

Invertebrates

Branchinecta conservatio
Conservancy fairy shrimp (E)
Critical habitat, Conservancy fairy shrimp (X)

Branchinecta lynchi
Critical habitat, vernal pool fairy shrimp (X)
vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
valley elderberry longhorn beetle (T)

Elaphrus viridis
Critical habitat, delta green ground beetle (X)
delta green ground beetle (T)

Lepidurus packardi
Critical habitat, vernal pool tadpole shrimp (X)
vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus
Critical habitat, delta smelt (X)
delta smelt (T)

Oncorhynchus mykiss
Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
California tiger salamander, central pppulation (T)

Rana aurora draytonii
California red-legged frog (T)

Reptiles

Thamnophis gigas
giant garter snake (T)

Birds

Haliaeetus leucocephalus
bald eagle (T)

Rallus longirostris obsoletus
California clapper rail (E)

Mammals

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Plants

Cordylanthus mollis ssp. mollis
soft bird's-beak (E)

Lasthenia conjugens
Contra Costa goldfields (E)
Critical habitat, Contra Costa goldfields (X)

Proposed Species

Plants

Cirsium hydrophilum var. hydrophilum
Critical habitat, Suisun thistle (PX)

Cordylanthus mollis ssp. mollis
Critical habitat, soft bird's-beak (PX)

Candidate Species

Fish

Oncorhynchus tshawytscha
Central Valley fall/late fall-run chinook salmon (C) (NMFS)
Critical habitat, Central Valley fall/late fall-run chinook (C) (NMFS)

Key:

(E) *Endangered* - Listed (in the Federal Register) as being in danger of extinction.
(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.
(P) *Proposed* - Officially proposed (in the Federal Register) for listing as endangered or threatened.
(NMFS) Species under the Jurisdiction of the National Marine Fisheries Service. Consult with them directly about these species.
Critical Habitat - Area essential to the conservation of a species.
(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.
(C) *Candidate* - Candidate to become a proposed species.
(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, or may be affected by projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regard-less of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the quad or quads covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the nine surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All plants and animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of

two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compen-sates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our critical habitat page for maps.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be September 26, 2006.

APPENDIX C

CEQA Environmental Checklist

APPENDIX C

Environmental Checklist Form

1. Project title: Blacklock Restoration Project

2. Lead agency name and address:

   California Department of Water Resources
   3251 "S" Street
   Sacramento, CA 95816

   U.S. Bureau of Reclamation
   Mid Pacific Region
   2800 Cottage Way
   Sacramento, CA 95825

3. Contact person and phone number:
   California Department of Water Resources: Terri Gaines 916.227.7522
   U.S. Bureau of Reclamation: John Robles 916.978.5558

4. Project location:
   Eastern Suisun Marsh, Solano County

5. Project sponsor's name and address:

   California Department of Water Resources
   3251 "S" Street
   Sacramento, CA 95816

   U.S. Bureau of Reclamation
   Mid Pacific Region
   2800 Cottage Way
   Sacramento, CA 95825-1898

6. General plan designation: NA

7. Zoning: NA

8. Description of project:
   The Department of Water Resources (DWR), in cooperation with the California Department of Fish and Game (DFG), U.S. Bureau of Reclamation (Reclamation), U.S. Fish and Wildlife Service (FWS), and the Suisun Resource Conservation District (SRCD) propose to restore 70 acres of diked, managed marsh to tidal wetlands, using a minimally engineered approach. The proposed action is to construct a levee breach in two locations along the property. These locations would maximize sediment accretion and subsidence reversal on the property. In addition, the breaches would be designed to provide full tidal exchange.

9. Surrounding land uses and setting: Briefly describe the project's surroundings:

   The action area is located in the northeast Suisun Marsh bordering Little Honker Bay on the north, and Arnold Slough on the west and south. The east side of the property is adjacent to Suisun Marsh ownership 604, a privately managed seasonal wetland. Much of the surrounding

area are seasonal wetlands managed for waterfowl, bays and sloughs.

The parcel is approximately 70 acres, which includes about 67 acres seasonal wetland and 3 acres upland/levee. Existing site features include a diked, managed marsh, a partial remnant network of sloughs, an interior borrow ditch, and seasonally and perennially ponded areas. There is fringing tidal marsh on the outboard side of the exterior levees.

10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.)

The DWR, USBR, DFG, FWS, and Suisun Resource Conservation District are working together as the Suisun Marsh Charter Group and support the implementation of this restoration project.

This project will be permitted under the JARPA process. Through this process, DWR will obtain a Nationwide Permit 27 (Restoration) from the US Army Corps of Engineers, 401 Certification from the Regional Water Quality Control Board, San Francisco Bay Conservation and Development Commission Approval. The Federal Action agency (Reclamation) has determined that the proposed action would not likely adversely affect listed species, based upon the evaluation in the Biological Assessment and upon informal consultations with FWS, & NMFS, and discussion with DFG. DFG will be informally consulted under the California Endangered Species Act. If any new information or environmental impacts unknown at this time become apparent through informal consultation, DWR will revise the project description and Reclamation will reconsult if necessary.

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

Aesthetics	Agriculture Resources	Air Quality
Biological Resources	Cultural Resources	Geology /Soils
Hazards & Hazardous Materials	Hydrology / Water Quality	Land Use / Planning
Mineral Resources	Noise	Population / Housing
Public Services	Recreation	Transportation/Traffic
Utilities / Service Systems	Mandatory Findings of Significance	

DETERMINATION: (To be completed by the Lead Agency)

On the basis of this initial evaluation:

I find that the proposed project COULD NOT have a significant effect on the environment, and

a NEGATIVE DECLARATION will be prepared.

X I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature — Date: June 28, 2006

Signature — Date: June 28, 2006

EVALUATION OF ENVIRONMENTAL IMPACTS:

1) A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

2) All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

3) Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

4) "Negative Declaration: Less Than Significant With Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from Section XVII, "Earlier Analyses," may be cross-referenced).

5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). In this case, a brief discussion should identify the following:
   a) Earlier Analysis Used. Identify and state where they are available for review.
   b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.
   c) Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

6) Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.

7) Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

8) This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

9) The explanation of each issue should identify:

a) the significance criteria or threshold, if any, used to evaluate each question; and
b) the mitigation measure identified, if any, to reduce the impact to less than significance

Issues:

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
I. AESTHETICS -- Would the project:				
a) Have a substantial adverse effect on a scenic vista?				X
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?				X
c) Substantially degrade the existing visual character or quality of the site and its surroundings?				X
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?				X
II. AGRICULTURE RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?				X
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?				X
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?				X
III. AIR QUALITY -- Where available, the significance criteria established by the applicable				

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?				X
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?				X
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?				X
d) Expose sensitive receptors to substantial pollutant concentrations?				X
e) Create objectionable odors affecting a substantial number of people?				X
IV. BIOLOGICAL RESOURCES -- Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?			X	
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?				X
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?			X	
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of				X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
native wildlife nursery sites?				
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?				X
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?				X
V. CULTURAL RESOURCES -- Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in '15064.5?				X
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to '15064.5?				X
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?				X
d) Disturb any human remains, including those interred outside of formal cemeteries?				X
VI. GEOLOGY AND SOILS -- Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				X
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.				X
ii) Strong seismic ground shaking?				X
iii) Seismic-related ground failure, including liquefaction?				X
iv) Landslides?				X
b) Result in substantial soil erosion or the loss of topsoil?				X
c) Be located on a geologic unit or soil that is				

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?				X
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?				X
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?				X
VII. HAZARDS AND HAZARDOUS MATERIALS B Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?				X
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?				X
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?				X
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?				X
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area? NA				
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area? NA				
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?				X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?				X
VIII. HYDROLOGY AND WATER QUALITY -- Would the project:				
a) Violate any water quality standards or waste discharge requirements?				X
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?				X
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?				X
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?			X	
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?				X
f) Otherwise substantially degrade water quality?				X
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?				X
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?				X
i) Expose people or structures to a significant risk				

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?				X
j) Inundation by seiche, tsunami, or mudflow?				X
IX. LAND USE AND PLANNING - Would the project:				
a) Physically divide an established community?				X
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?				X
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?				X
X. MINERAL RESOURCES -- Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?				X
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?				X
XI. NOISE -- Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?				X
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?				X
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?				X
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?				X
e) For a project located within an airport land use				

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels? NA				
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels? NA				
XII. POPULATION AND HOUSING -- Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?				X
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?				X
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?				X
XIII. PUBLIC SERVICES				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
Fire protection?				X
Police protection?				X
Schools?				X
Parks?				X
Other public facilities?				X
XIV. RECREATION --				
a) Would the project increase the use of existing neighborhood and regional parks or other				

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?				X
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?				X
XV. TRANSPORTATION/TRAFFIC -- Would the project:				
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?				X
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?				X
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that result in substantial safety risks?				X
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?				X
e) Result in inadequate emergency access?				X
f) Result in inadequate parking capacity?				X
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?				X
XVI. UTILITIES AND SERVICE SYSTEMS B Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?				X
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?				X

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?				X
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?				X
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?				X
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?				X
g) Comply with federal, state, and local statutes and regulations related to solid waste?				X
XVII. MANDATORY FINDINGS OF SIGNIFICANCE --				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?				X
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?				X
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?				X

Explanation of Issues identified as "less than significant impacts"

BIOLOGICAL RESOURCES

IV a. Salt marsh harvest mice, a State and federally listed endangered species have been found in the vicinity of the proposed project. Implementation of the proposed action is not expected to cause a significant adverse effect, either directly or through habitat modifications because the pond is currently flooded, and has been since January 2006. Avoidance and minimization measures, including SMHM trapping, as specified by the USFWS will occur in the location of the levee breaches, prior to and following construction. This project should have a net, long term benefit to listed fish species, including delta smelt. Sensitive fish species are not expected to be present during construction.

One goal of this project is to provide habitat for native species, including listed and sensitive species. Restoring tidal inundation to this property may provide habitat for listed and sensitive fish species. The monitoring program includes surveying for SMHM in any available habitat, and conducting surveys for fish and avian species.
No rare, threatened or endangered plant species are found in the project area.

IV c. This project will convert 67 acres of managed seasonal wetlands to tidal wetlands. There may be minor, temporary impacts to jurisdictional wetlands during construction of the levee breaches. Fill material may be placed in the borrow ditches to construct ditch blocks or in the ponds to raise subsided pond elevations. The project will provide long term benefits through the creation of tidal wetlands for multi-species benefits. Prior to project implementation, the project area is jurisdictional wetlands.

HYDROLOGY AND WATER QUALITY

VIII d. Implementation of this project will alter the tidal prism in this area, although because the area of inundation is relatively small, effects on water quality (salinity) is expected to be minimal. A water quality monitoring network has been installed in the adjacent sloughs and is collecting water quality data prior to and following the proposed levee breach. A methyl mercury monitoring program will be conducted as part of this project. There may be a short term (temporary) degradation of water quality in the area (turbitidy and low do) during construction.